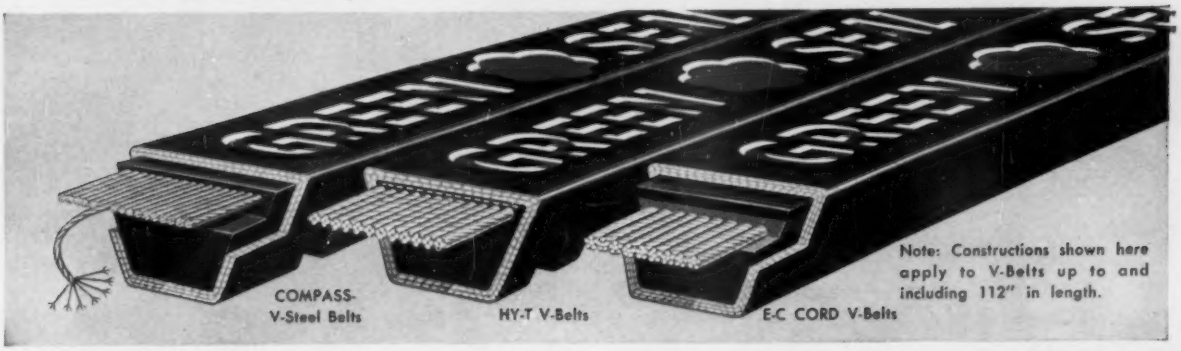
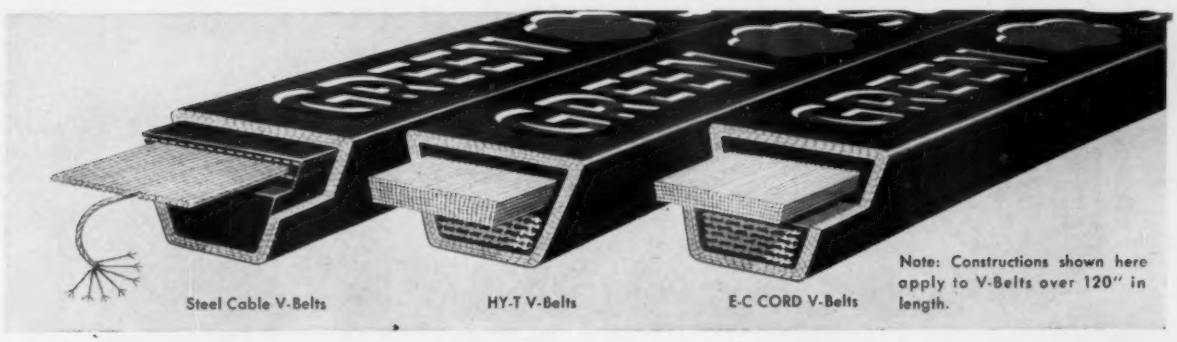
What's different about


COMPASS-
V-Steel Belts
HY-T V-Belts
E-C CORD V-Belts
Note: Constructions shown here apply to V-Belts up to and including 112" in length.

V-Belts with the Green Seal?



Plenty—when you're belting multiple drives. For that Green Seal certifies the dimensional stability of every belt that carries it. There's no surer guarantee that every belt in a set will match every other one—perfectly. And that they'll *stay* matched no matter how long you stock them before installation.

So the dimensional stability of Green Seal belts is solid protection against "loafing," slipping, stretching, scorching and other mismatching troubles. And most of the credit belongs to the belts' load carriers of airplane-type steel cables or Triple-Tempered (3-T) cord – Goodyear "exclusive" cord that's carefully tempered with Tension, Temperature and Time.

This unique 3-T process brings the synthetic cord to its point of greatest strength and stability. Result: the end of shrinkage in storage—plus greatest shock- and stretch-resistance in use. All of which assures you maximum, trouble-free horsepower hours at minimum cost. Why settle for less?

DIMENSIONALLY STABLE V-BELTS with the GREEN SEAL by GOODYEAR

THE GREATEST NAME IN RUBBER

The Goodyear Tire & Rubber Company, Dept. 794, Akron 16, Ohio

Please send me complete information on what makes V-Belts with the Green Seal different from any others made today.

Name_____

Company_____

Street Address_____

City_____ Zone_____ State_____

Compass, E-C Cord, Hy-T, Green Seal—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

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'ROUND ABOUT with the editors in field and office

Edited by R. L. Marinello

See You at Booth 601

DURING YOUR visit to the Plant Maintenance and Engineering Show in Chicago, don't forget to stop at the PLANT ENGINEERING booth. The booth number is 601. The show will be at the International Amphitheatre from January 27 through the 30.

Be it to rest your feet, for pleasant conversation, or if you must, to complain, we'll be glad to see you.

Conferences in February

THIRD NATIONAL Industrial Electric Heating Conference will be held at the Netherland Hilton Hotel, Cincinnati, Ohio, from February 3 through the 6.

The American Institute of Electrical Engineers will utilize both the Hotel Statler and Sheraton-McAlpin Hotel in New York for the 1958 Winter General Meeting, which will be held from February 3 through the 7.

Reinforced Plastics Division of The Society of the Plastics Industry, Inc., is returning to Chicago for its 13th Annual Technical and Management Conference on February 4 through the 6. Conference and an industry exhibit will be held at the Edgewater Beach Hotel.

"Putting the Squeeze on Costs," will be the theme of an all-day conference to be held at the Cleveland Engineering Society, Cleveland, Ohio, on February 17. Speakers will present papers on plant layout, work simplification, inventory and tool control, material handling and planning and scheduling.

Seventh Annual Industrial Ventilation Conference will be held at Michigan State University, East Lansing, Michigan, from February 17 through the 20. Various design problems will be presented to illustrate basic ventilation principles along with demonstrations and lectures giving information and data about current good practice in ventilation design.

Maintenance Is Getting Bigger

MAINTENANCE WILL serve an ever-growing and important role in the expanded industry of tomorrow. This was predicted by C. E. Sutton, Jr., manager of marketing for General Electric's Service Shops Department, at a recent meeting of the St. Louis section of the American Society of Mechanical Engineers.

"Industry must realize that the more rapidly it progresses toward automation, the more it spends for larger, finer and more elaborate tools, the more urgent and necessary becomes a planned productive maintenance program to insure that profits will be returned from the investment in facilities and equipment."

"The days are gone forever when a good all-around mechanic can be the maintenance boss. Instead, the maintenance engineer will manage the largest direct labor force in the highly mechanized plant of the future."

New Appointment at Chrysler

John von Rosen has been named director of manufacturing engineering for Chrysler Corporation. In his new capacity, he will be in charge of production, industrial and plant engineering activities.

He joined the company on a part-time basis in 1927 and became a full-time employee in 1932. At that time, he became plant layout engineer at Plymouth. He was named assistant plant engineer in 1938 and four years later became the division's plant engineer.

From 1949 to 1952 he served on the staff of the vice president and general manager of Chrysler Corp., handling special assignments in connection with plant construction. In 1952, he became director of plant engineering.

Making the Move Easy

PLANTS FACED with the problem of moving to a new location can well sympathize with the Wolverine Tube Division of Calumet and Hecla, Inc., and the problems they had to face when they recently moved to their new administrative quarters in Allen Park, Michigan.

However, Wolverine had the situa-

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There's more to ITV than meets the eye

The magic of television offers a valuable new tool to American industry, institutions, transportation and utilities. In operation, industrial television (ITV) is simplicity itself. However, the assembly of all the equipment needed for a complete installation—and that's where Graybar enters the picture—has more to it than meets the eye.

First, the system needed must be planned for the job it is to do. Second, the components must be procured as rapidly and economically as possible. And here's where it will pay you to call Graybar *first*. For Graybar is your finest *single* source for *everything* in industrial television equipment:

ITV cameras . . . monitors . . . receivers (direct view or projection) . . . distribution equipment . . . via coaxial cable . . . via microwave . . . via common-carrier . . . lighting – indoors and out . . . test equipment . . . tubes . . . sound equipment . . . picture recording equipment . . . pole lines and hardware . . . tools . . . viewfinders . . . lenses . . . remote control . . . intercommunication equipment . . . engineering service* . . . maintenance service* . . . ITV EXPERIENCE.

We have compiled a brand new 56-page catalog which contains descriptions and data on the equipment needed for an industrial television system. We will be more than glad to send to any firm located in the U.S. a copy of this catalog. No cost or obligation, of course,—simply write us on your company letterhead. 618-177

*through qualified service organizations

CALL **GraybaR** FIRST FOR

GRAYBAR ELECTRIC COMPANY, INC., 420 LEXINGTON AVENUE, NEW YORK 17, NEW YORK, IN OVER 130 PRINCIPAL CITIES

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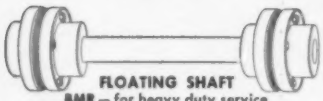
FOR MAINTENANCE FREE POWER TRANSMISSION

Specify

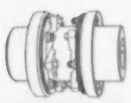
THOMAS

FLEXIBLE COUPLINGS

DOUBLE FLEXING
DBZ — for high speed, heavy duty drives



FLOATING SHAFT
BMR — for heavy duty service with excessive misalignment



DOUBLE FLEXING
AMR — for engine and medium speed drives

SINGLE FLEXING
SS — for engine-driven generator sets with out-board bearings

Thomas' 40 years of flexible coupling experience is at your disposal to help you meet ordinary applications or special variations for unusual cases.

UNDER LOAD and MISALIGNMENT ONLY THOMAS FLEXIBLE COUPLINGS OFFER ALL THESE ADVANTAGES.

1 Freedom from Backlash Torsional Rigidity
2 Free End Float
3 Smooth Continuous Drive with Constant Rotational Velocity
4 Visual Inspection While in Operation
5 Original Balance for Life
6 No Lubrication
7 No Wearing Parts
8 No Maintenance

Write for Engineering Catalog 51-A

THOMAS FLEXIBLE COUPLING CO.

WARREN, PENNSYLVANIA, U. S. A.

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'ROUND ABOUT

tion well in hand. They made each and every step count with regard to moving the equipment and informing the personnel involved in the move. Each employee was presented with a package consisting of a two-page instruction sheet and two brochures.

One brochure shows a picture of the new facilities and presents a little historical background about the company. The other brochure, entitled "It's Your Move," gave instructions on how to drive out to the new plant. A map was also included. Other information in the booklet told what services were available at the new building, answered questions about the parking lot, hanging pictures and what you can leave on your desk at the end of a work day, along with a list of eating places in the area.

Crystals May Explain Steel Failure

CRYSTALS, which grow as delicate plates from the surface of stainless steel, may explain the destructive failure known as "stress-corrosion cracking."

This new theory was revealed by Dr. Earl A. Gulbransen, advisory chemist at the Westinghouse Research Laboratories in Pittsburgh, Pa.

Dr. Gulbransen described the newly discovered crystals as "submicroscopic platelets of chromium oxide." They form on strongly stressed stainless steel specimens which are exposed to corroding atmospheres containing atoms — more properly referred to as chloride ions.

"We think," Dr. Gulbransen said, "that this growth of platelets on the surface of the steel could lead to a chemical cutting of the metal. Minute crevices, therefore, might grow downward into the metal surface as the platelets thrust themselves above it. This may lead to concentration of stress at the base of the crevices and eventually to failure of the metal."

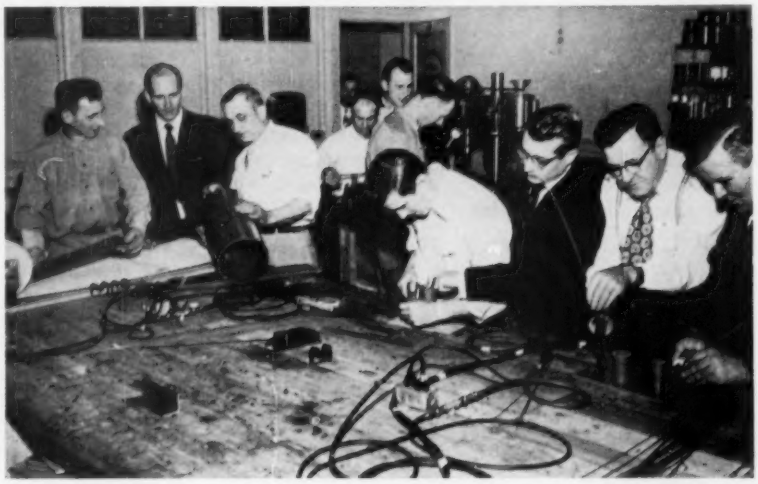
Engineering Changes at Goodrich

Charles L. Woods, Jr., was appointed plant engineer for the Louisville, Kentucky, plant of B. F. Goodrich Chemical Company. He was formerly supervising engineer at the Louisville plant. Woods succeeds **Russell C. Grover,** recently named plant engineer at the chemical firm's new Henry, Illinois, plant now under construction.

Woods joined the company in May, 1946. He became a senior chemical engineer in January, 1952, and general foreman of the Geon polyvinyl chloride facility in June, 1954. He assumed the duties of supervising engineer in February of this year.

Grover joined the company in 1942 as a mechanical engineer at the Louisville plant. He became a senior engineer in 1949, supervising engineer in 1951 and plant engineer in 1955.

Trainees Learn How To Work With Plastic Piping



Workable, on-the-job knowledge of plastic pipe and stock, its physical properties, fabrication and application, is provided by the training program at General Tire and Rubber Company's Bolta Products Division in Lawrence, Mass. Here, journeymen, pipe fitters and plumbers spend one hour in class followed by two hours of manual practice at each semi-weekly session. The instruction series is available to qualified tradesmen provided they have a minimum of four years' experience

Snap-Tite

QUICK-CONNECT

QUICK-DISCONNECT COUPLINGS

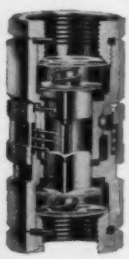
in larger sizes

immediate delivery

FROM FACTORY STOCKS

SNAP-TITE'S "H" COUPLING, SIZE FOR SIZE, IS THE SMALLEST COUPLING WITH HIGHEST STRENGTH AND HIGHEST EFFICIENCY.

Snap-Tite's "H" Couplings are now factory-stocked for quick shipment to you, not only in the smaller sizes (below 1" ID) but in all sizes up to and including 3"—in steel, brass, aluminum, and 303 and 316 **Stainless Steel.** And "H" Couplings can be made to your order, up to 10" ID.



Available with valves to give two-way or one-way automatic line shut-off, or without valves for straight-thru flow, "H" Couplings are built to handle high pressures in hydraulic and air systems.

Recessed valve washers . . . fluted valve stems . . . valve stops with minimum flow restrictions . . . large inside diameter—allow maximum flow capacity with lowest pressure drop.

See the Snap-Tite representative in your city or write for Bulletin 240.

Snap-Tite, INC.

UNION CITY 5, PENNSYLVANIA

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

See us at Booth #665 at the Plant Maintenance Show in Chicago

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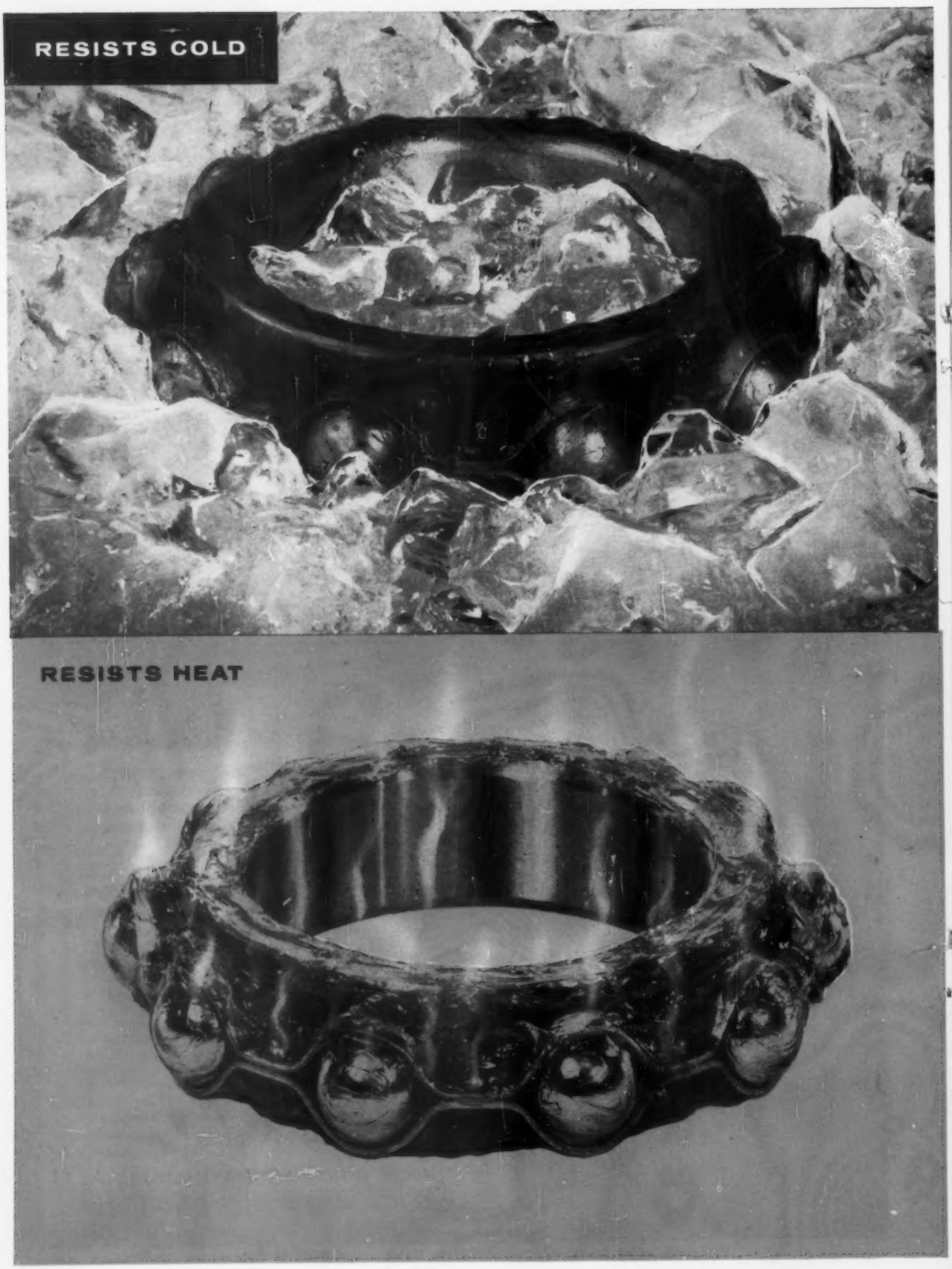

RESISTS COLD
RESISTS HEAT

NEW GULFCROWN GREASE

combats these three enemies of proper lubrication

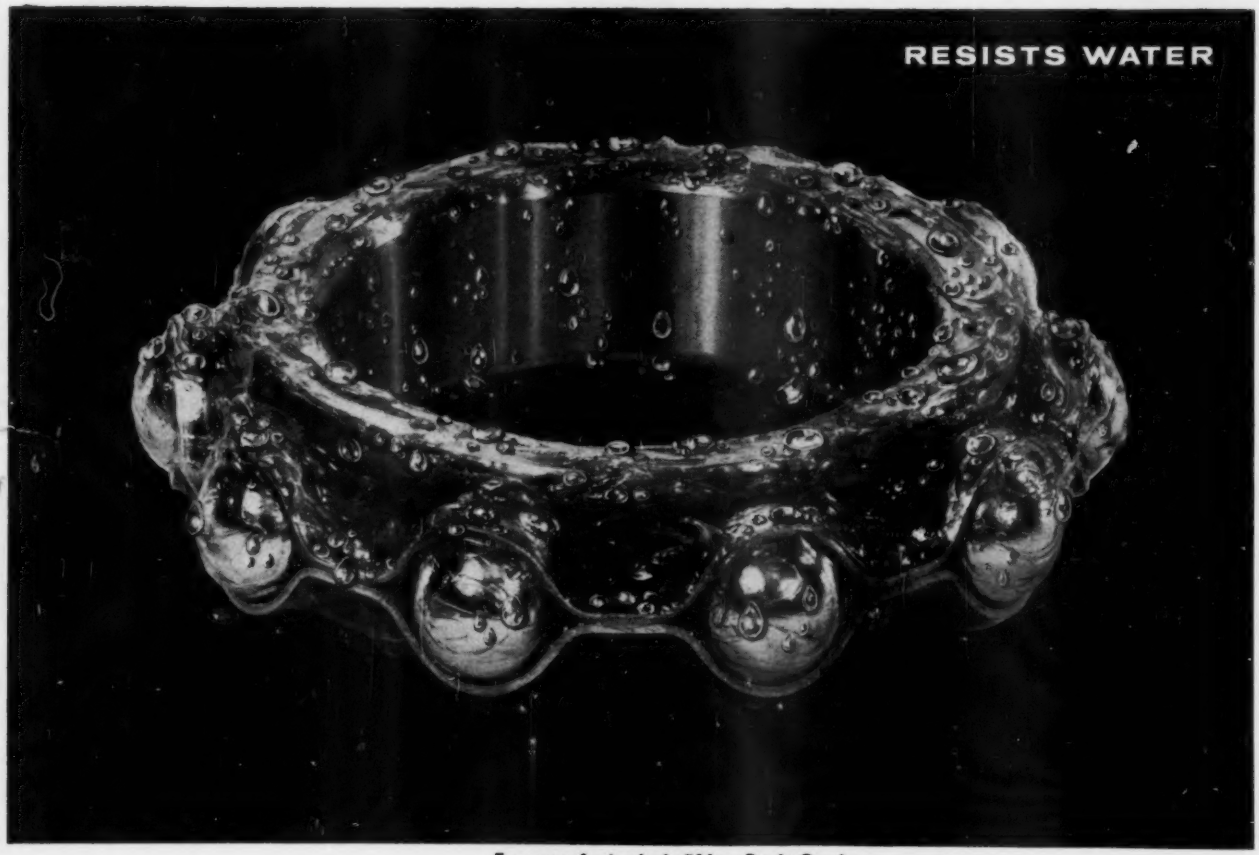
HEAT, COLD, WATER—new Gulfcrown grease works under conditions where many other greases fail!

This superior new lithium-base lubricant resists leakage—has excellent high temperature performance. It has excellent pumpability at 0°F (even lower under certain conditions). It resists removal from bearing surfaces even when washed with water. It can be applied from a centralized grease system or by grease gun.

Since its introduction earlier this year, Gulfcrown has proved itself an impressive money-saver—in steel, paper, and textile mills, and many other types of manufacturing plants. Gulfcrown's exceptional stability under adverse conditions reduces grease consumption. Its ability to serve many purposes simplifies lubricant storage and handling—avoids application errors. If you're looking for a grease you can use practically anywhere, Gulfcrown is it. Comes in N.L.G.I. consistencies 0, 1, 2, 3. Call your Gulf Sales Engineer now, or send for free literature.

GULF OIL CORPORATION
Department DM, Gulf Building
Pittsburgh 30, Pennsylvania

THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS



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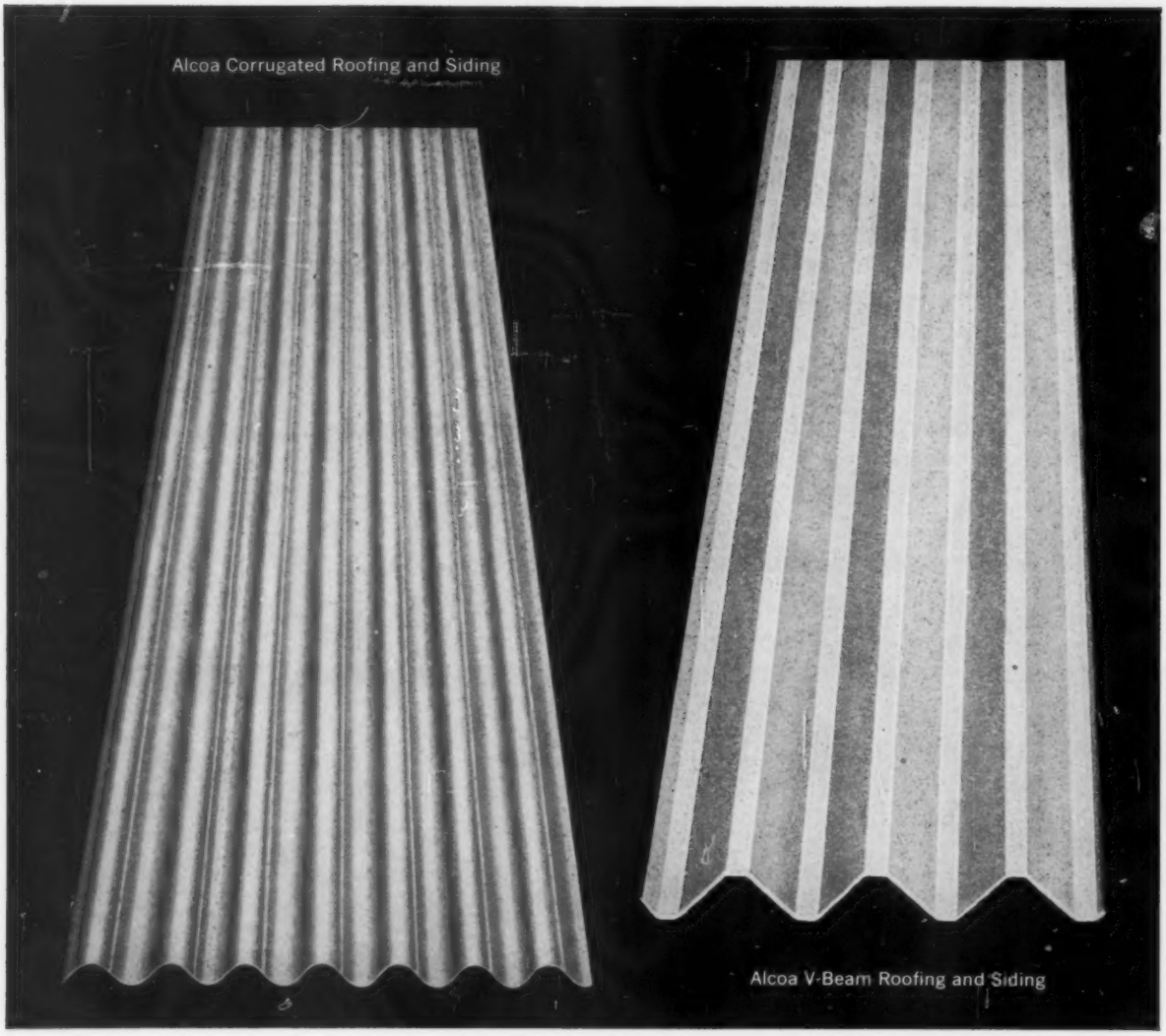
Five reasons why plant



These Alcoa Aluminum Industrial Building Products have five big benefits for any plant:

1. Less Maintenance—Aluminum resists corrosion and never needs painting. It will not rot, warp or shatter.

2. Lower Cost—Savings in erection and upkeep costs, plus longer life, make aluminum your most economical buy. *And sandwich walls of Alcoa® Aluminum provide the lowest cost insulated metal wall system available.*

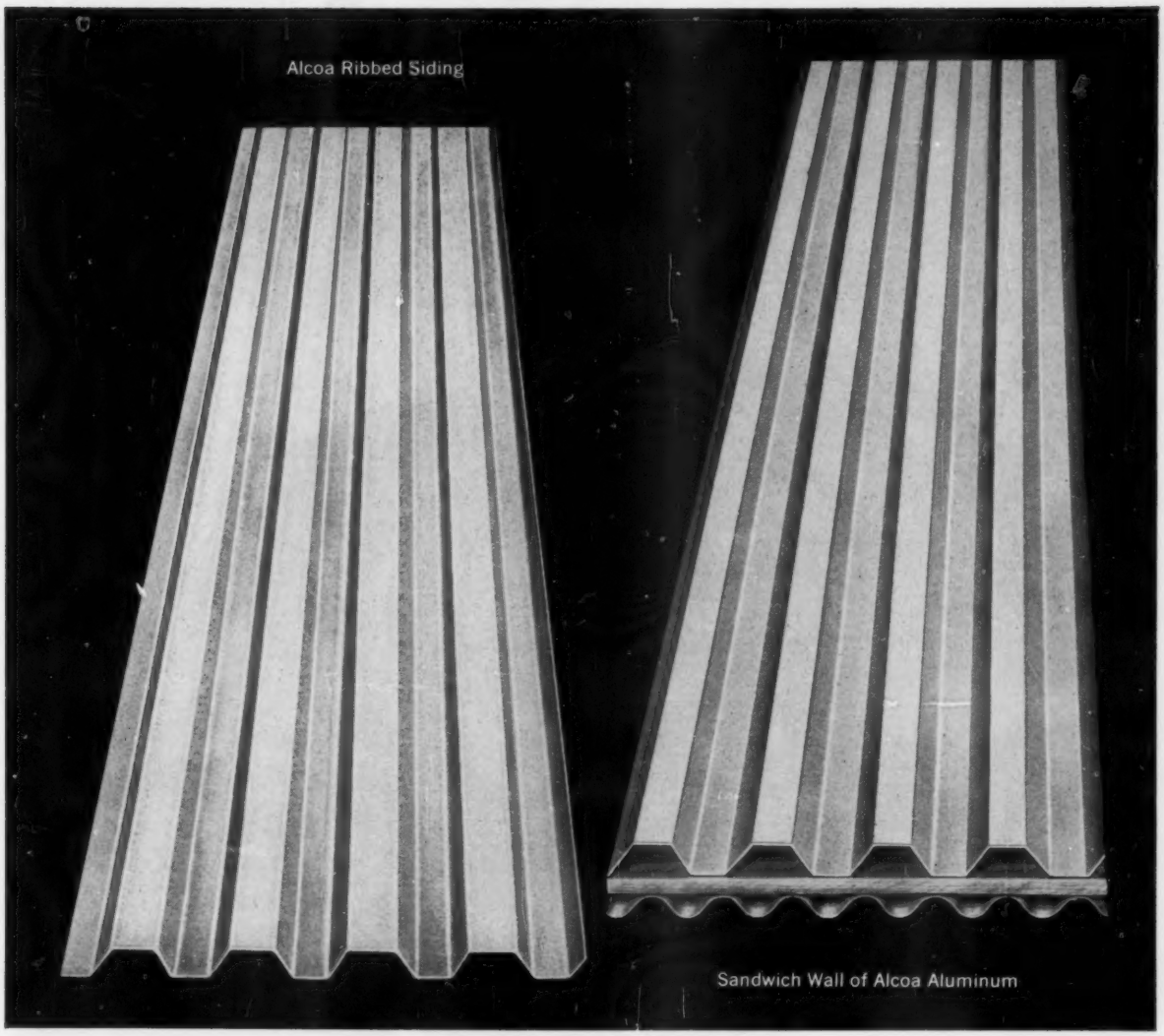
3. Better Looking—The clean-lined appearance of aluminum gives you a plant you and your neighbors can be proud of now . . . and years from now.

4. Easy to Handle—Lighter weight of aluminum reduces erecting costs, permits lighter foundations and framing. Larger sheet sizes reduce the number of joints.

5. Flexibility for Expansion—Aluminum-clad buildings expand easily to accommodate growing pains. Aluminum roofing and walls can be salvaged for re-use in different installations.

For more information on how Alcoa Aluminum Industrial Building Products can cut costs in your plant, and for the address of your nearest Alcoa Approved Applicator, call your local Alcoa sales office or write Aluminum Company of America, 858-A Alcoa Building, Pittsburgh 19, Pennsylvania.

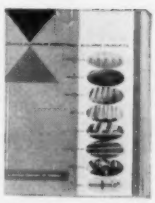
maintenance is going aluminum!



Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM
INDUSTRIAL BUILDING PRODUCTS
ALUMINUM COMPANY OF AMERICA

"ALCOA THEATRE"
Exciting Adventure
Alternate Monday Evenings



FREE fact book packed with technical information on how to build and save money with Alcoa Aluminum Industrial Building Products. Send for your copy now! Aluminum Company of America, 858-A Alcoa Bldg., Pittsburgh 19, Pennsylvania.

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NEW ROBBINS "SERIES 254U" RE-RATED FIVE BIG

FULL HEIGHT END HEAD PROTECTION
One piece shrouded end heads give full height protection against moisture and falling objects. Internal baffles complete splash-proof construction.

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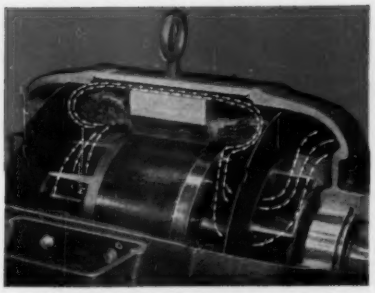
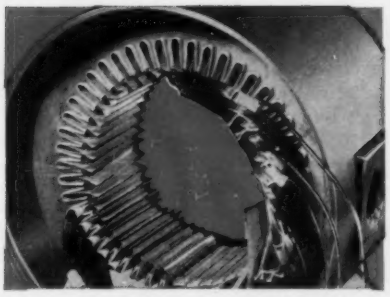
MOTORS offer you...

ADVANTAGES!



"STRAIGHT THROUGH" DUAL-SWEEP VENTILATION ELIMINATES "HOT SPOTS"

Tandem fans, one pushing and the other pulling, produce washing action around and over field coil ends, insure lower internal temperatures and longer dependable operation.



MYLAR* INSULATION INCREASES MOTOR LIFE. Mylar*, laminated to rag paper insures positive insulation and assures virtually permanent protection because of its excellent dielectric qualities. In addition, the rag paper backing provides a cushioning effect for added resistance to abrasions and punctures.

*DuPont registered trademark.

BEARINGS EASILY INSPECTED

Removable cover plate at each end of head permits easy bearing inspection without dismantling motor. Bearings run in double-width races, thus have extra-large reservoirs containing grease selected to resist dust, temperature, humidity and high operating speeds.

PERMANENTLY NUMBERED LEADS SIMPLIFY INSTALLATION AND MAINTENANCE

Proper lead identification is assured even after years of exposure. Numbers are permanently impregnated into the sub-surface of the insulation . . . can't wear off or deteriorate.

THESE five big advantages make R&M's "Series 254U" re-rated motors your best buy for applications requiring dependable, full-time performance. They can be installed in any environment, outdoors without a cover or in damp and corrosive atmospheres. Moisture, rust or corrosion can't affect their operation, and they take rugged duty in stride! Every R&M motor is electrically and mechanically designed to withstand the most severe operating conditions. Careful quality control and precision manufacture insure top performance and dependability year after year. Write today, for R&M Bulletin 520PEon R&M's "Series 254U" re-rated motors!

ROBBINS & MYERS, INC.

SPRINGFIELD, OHIO / BRANTFORD, ONTARIO

Motors Fans Hoists Moyno® Pumps Propellair® (Industrial) Fans

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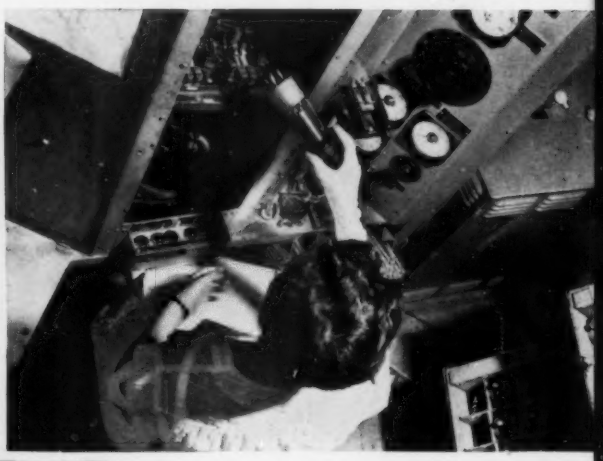
NOW...AUTOMATED TESTING OF



ABOVE: operator inserts a GL-6807 thyratron in rotating mechanism that carries all tubes automatically through an extensive series of performance checks.

LEFT: full-scale view of G.E.'s automated test equipment for thyratrons—the only one of its kind. Racked tubes ready for testing are at operator's right. Among the important checks that G-E thyratrons receive are tests for heater current; for peak anode voltage; peak cathode current; grid emission; and tube control characteristics. These and many other tests, automatically and infallibly applied to every tube, mean proved-in-advance performance for all General Electric thyratrons.

To fully proved performance, add these G-E tube-design plusses that give you better thyratron performance, longer life:

CONTROLLED MERCURY CONTENT. The closely controlled mercury content in G-E mercury-filled thyratrons means that (1) initial mercury distribution time is cut down, (2) tubes can be mounted with greater freedom. A special capsule is flashed inside G-E tubes after the latter have been exhausted, providing correct amount of mercury, with no excess.

NEW LONG-LIFE BASING COMPOUND. A new, superior epoxy-resin compound for bases and anode caps adds greatly to G-E thyratron life. This compound is "predictable" when applied—has a minimum tendency to weaken or deteriorate. Bases and anode caps stay in place.

SUPERIOR CATHODE COATING. General Electric's unique method of cathode processing gives superior adherence to the coating of the cathode; helps prevent flaking off. Increased tube life—better thyratron performance—both are direct results of the G-E method.

NEWEST TYPES AVAILABLE. New types—new improvements—constantly are being added to General Electric's line of thyratrons, long the industry's largest. Important recent new tubes are the GL-6807, 8, and 9 thyratrons for motor control, with external anode and grid cooling. First to develop and build thyratrons, General Electric continues to maintain design leadership

GENERAL ELECTRIC THYRATRONS!

Performance of tubes is fully proved before you install them

Automated testing of G-E thyratrons—described at left—means proved-in-advance performance. This General Electric "first" solidly protects your tube investment. Your dollars buy pre-tested quality when you replace with General Electric thyratrons . . . and 46 types give full coverage of your factory requirements. Check the thyratron replacement list that follows; then phone your local G-E tube distributor for fast delivery service to your door! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.*

Use this guide to fill ALL your replacement needs with G-E Quality Thyratrons:

G-E THYRATRON	WILL REPLACE:
2D21	WL-2D21 2D21, other makes WT-210-0001
GL-3C23	NL-3C23 WL-3C23 3C23, other makes CE-311
GL-5C21/C6J	C6J C6J/5C21
FG-27-A	
FG-81-A	WL-81-A
FG-97	
FG-98-A	FG-98-A, other makes
FG-105	WL-105 105, other makes AX-105/FG-105 WT-210-0079
FG-154	
FG-172	WL-172 172, other makes WT-T149 WT-210-0038 WT-210-0078
GL-393-A	NL-393-A WT-210-0067
GL-414	WL-414
502-A	WL-502-A 502-A, other makes
GL-627	KU-627 627, other makes
GL-672-A	WL-672-A 672-A, other makes 672
GL-678	WL-678 678, other makes
884	DR-884 RX-884 WL-884 884, other makes 6Q5-G WT-210-0003
885	RX-885 WL-885 885, other makes 284
2050	RK-2050 WL-2050 2050, other makes WL-630 WL-630-A WT-210-0004
GL-5528/C6L	C6L
GL-5544	5544, other makes
GL-5557/FG-17	WL-17 17 CE-309 NL-715 NL-715/5557 ML-728 UE-967 967 1701 5557 WL-5557/17 AX-5557/FG-17/1701 WT-210-0015 WT-210-0062 WT-210-0069
GL-5559/FG-57	AX-5559 5559 NL-5559/FG-57 WL-5559/57 WL-57 WL-631 WT-210-0056
GL-5560/FG-95	NL-5560/FG-95 5560 WL-632-B (certain design differences) WT-210-0057 WT-210-0116
GL-5632/C3J	C3J/5632 EL-C3J 5632 WT/210-0043 WT/210-0106
5662	
5663	
GL-5665/C16J	C16J/5665 EL-C16J 5665
5696	5696, other makes
GL-5720/FG-33	NL-5720/FG33 WL-33
5727	WT-210-0077
GL-5728/FG-67	5728/FG-67, other makes 1904
GL-5830/FG-41	WL-41 WT-210-0054
GL-5855	
GL-5948	5948, other makes 5948/1754 1754
GL-6011/710	WL-6011/710 GL-5632/C3J NL-710 NL-710/6011
GL-6014/C1K	6014 EL-C1K C1K/6014
GL-6044	
6525	
GL-6807	C6J-A/568 EL-C6J EL-C6J/A EL-C6J/K NL-760 WT-210-0063 WL-5685/C6JA
GL-6808	EL-C6J/F EL-C6J/KF NL-760-P
GL-6809	EL-C6J/KL EL-C6J/L NL-760-L
GL-6855/716	NL-716
GL-6856/740	NL-740 WT-210-0017
GL-6857/740-P	NL-740-P
GL-6860/C6J/F	C6J/F

Progress Is Our Most Important Product

GENERAL ELECTRIC

161-1D3

For more facts circle 509 on Reply Card

"We cut Electrical Installation Costs and got better protection

. . . by installing Fusetron Fuses throughout our New Dairy Plant!"

William J. Oyala
ELECTRICAL SUPERVISOR
Fred Meyer Co. Portland, Oregon

Mr. Oyala continues . . .

"In our new dairy plant in Portland, Fusetron dual-element fuses saved us about $800 by enabling us to use the proper switch sizes for the motor disconnects. This was possible because the long time-lag of Fusetron fuses permitted us to install them in smaller sizes than would have been possible with ordinary fuses.

"In addition, we were able to reduce the space required by the control centers.

"The Fusetron fuses were installed in sizes small enough to give us motor-running protection as well as motor branch circuit protection.

"The result of this has been the prevention of motor burnouts. Not once in the past year of operation has a Fusetron fuse failed to protect a motor. We have 138 motors, ranging from 1/40 H.P. to 100 H.P., and all are protected by Fusetron fuses.

"Both Mr. Eric Christenson, whose company contracted the electrical work, and myself believe that by installing Fusetron fuses throughout our entire plant we got top protection at a cost lower than could have been obtained by any other method."

FUSETRON DUAL-ELEMENT FUSES PROVIDE SAFER, MORE DEPENDABLE PROTECTION

Only Fusetron fuses provide 10 point protection—not possible with any other type of protective device.

Thus, wherever a Fusetron fuse is installed you have safety as sure and dependable as you can buy—no matter what you pay.

AND FUSETRON FUSES REMAIN SAFE THROUGH THE YEARS . . . NO MAINTENANCE COSTS

Once properly installed Fusetron fuses are maintenance free. They require no costly inspection or downtime for calibration and other maintenance necessary on mechanically operated devices.

Dust, fumes, corrosion or age cannot prevent a Fusetron fuse from opening safely. There are no hinges, pivots or contacts to stick or slow down the operation of the fuse on short-circuit.

NO RECALIBRATION COSTS

When a Fusetron dual-element fuse does blow, there is no recalibration needed. As quickly as the fault in the circuit is corrected, you slip in a new fuse. The new Fusetron fuse is just as it came from the factory—accurately calibrated—and ready to give the same safe, dependable, coordinated protection as did the one it replaced.

FOR LOADS ABOVE 600 AMPS.—USE BUSS Hi-Cap FUSES to coordinate with FUSETRON Fuses.

On 600 volts or less, BUSS Hi-Cap fuses have an interrupting capacity sufficient to handle any fault current regardless of system growth.

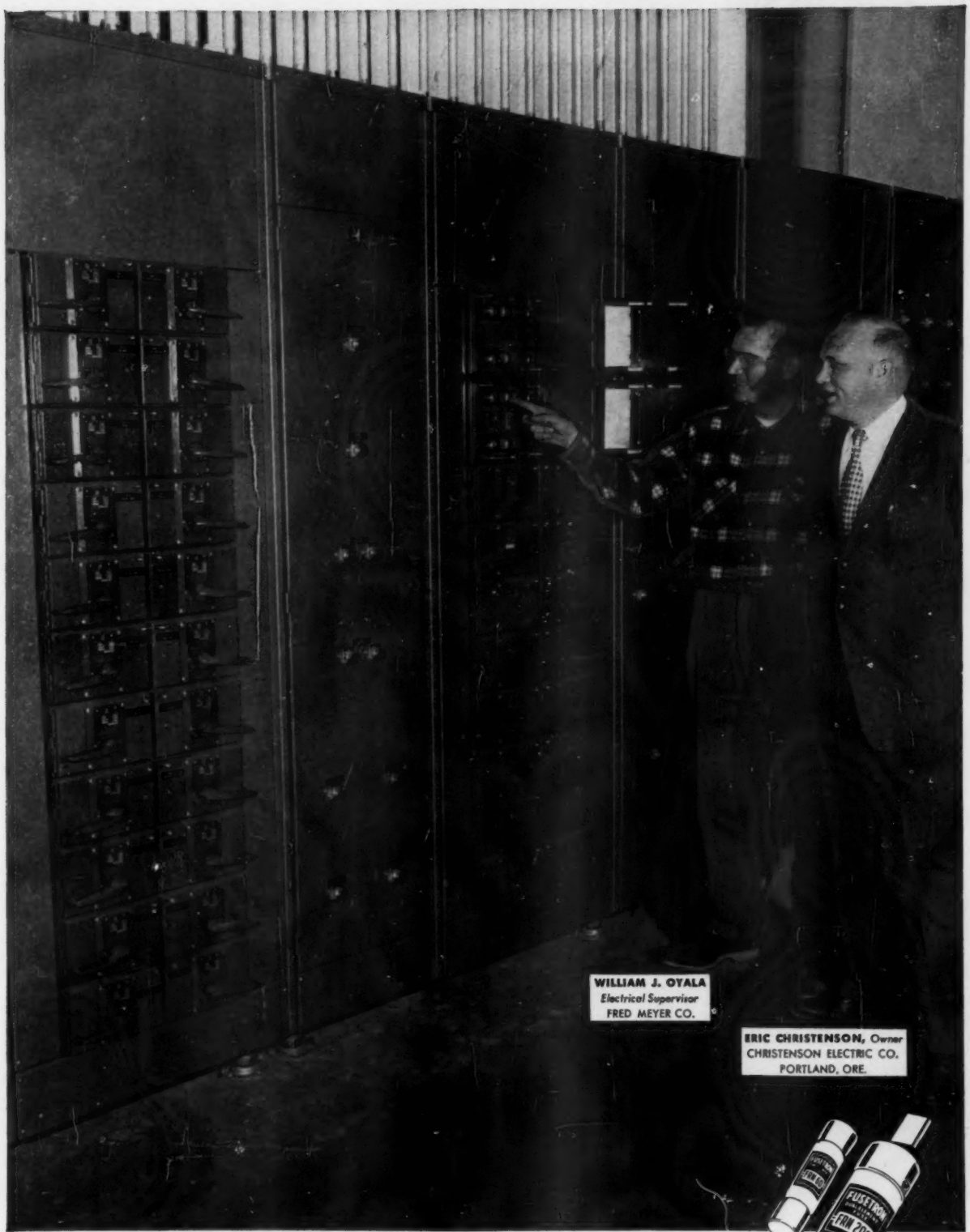
They can be coordinated with Fusetron fuses on feeder and branch circuits to limit fault outage to circuits of origin.

Write for bulletin HCS.

For more information on FUSETRON dual-element Fuses . . . Write for bulletin FIS.

BUSSMANN MFG. DIVISION McGraw-Edison Co.
University at Jefferson, St. Louis 7, Mo.

NATIONAL ELECTRICAL WEEK
FEB. 9-15, 1958



Play Safe! Install Fusetron dual-element fuses and BUSS Hi-Cap Fuses throughout entire Electrical System!

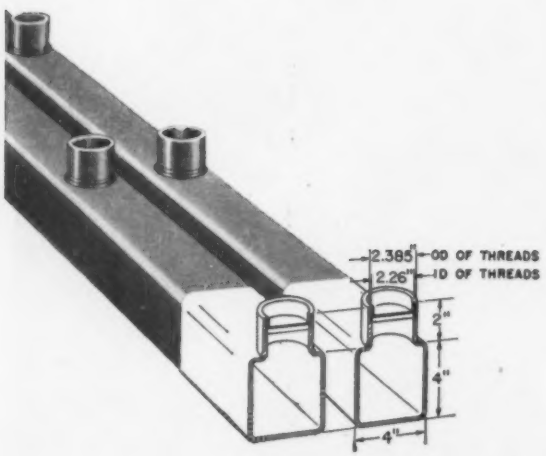
For more facts circle 510 on Reply Card

Eliminate overhead wiring hazards...

SPECIFY

JUMBODUCT

INDUSTRIAL UNDERFLOOR ELECTRICAL RACEWAYS



Versatile in design, National Electric Jumboduct offers plenty of capacity for production line wiring . . . eliminates the hazard of overhead wiring . . . permits flexible, attractive plant layouts by providing for readily accessible electrical distribution in the floor at a minimum cost.

A Jumboduct system in your plant means:

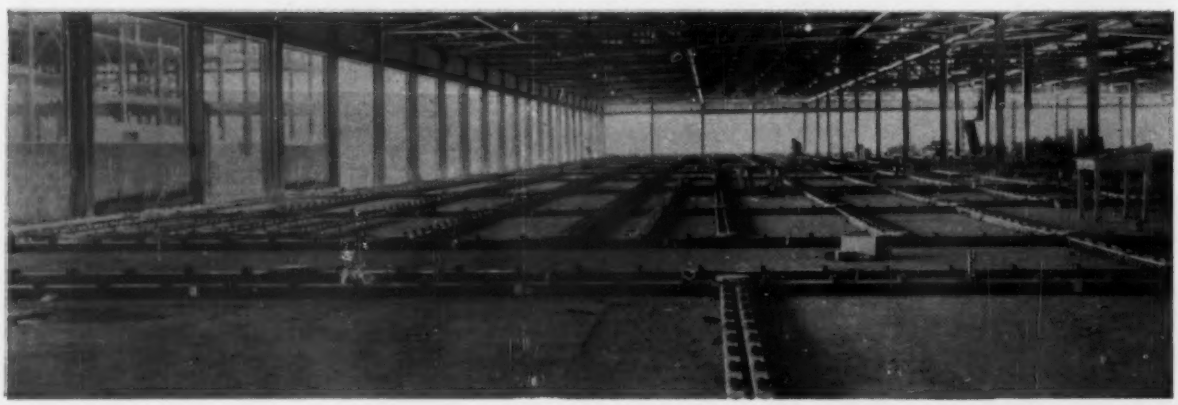
Plenty of capacity
4" x 4" Cross Section—more room for wires

Efficient power distribution
2" pipe threaded outlets every 24" permits exact location of equipment

Low Cost
- Easy-to-handle 10′ lengths
- Same simple installation procedure as standard Nepcoduct
- Quick access to inserts
- Investment in conductors limited to today's needs with ample space for tomorrow's additions

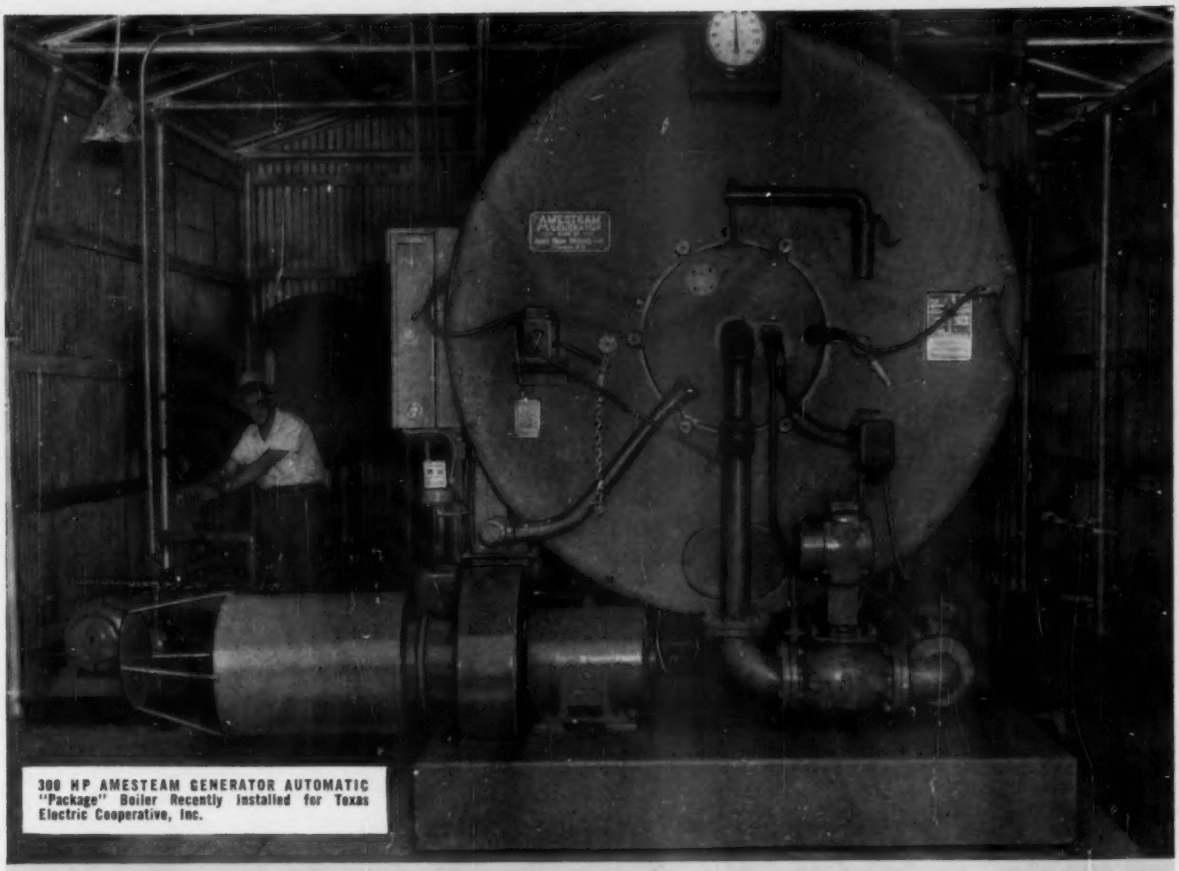
Safety
- Protected against corrosion by Sherardizing
- Coated with a baked-on acid-resisting enamel
- A completely grounded all-steel system

Get the details on JUMBODUCT today! Write for your free copy of the engineering Data Book on NE JUMBODUCT.



National Electric Products
PITTSBURGH, PA.
2 Plants • 12 Warehouses • 41 Sales Offices

For more facts circle 511 on Reply Card



300 HP AMESTEAM GENERATOR AUTOMATIC "Package" Boiler Recently Installed for Texas Electric Cooperative, Inc.

TEXAS ELECTRIC COOPERATIVE, INC.

Cuts Fuel Consumption Over 36%
Saves Over $15,000 per year
... with AMESTEAM GENERATOR

We Quote the Money-Saving Facts:

"We were very pleased when we replaced two gas-fired boilers in our presssure testing plant with one new 300 HP AMESTEAM GENERATOR Automatic "Package" Boiler. The new Ames unit has reduced our fuel costs alone by 38% ... a saving of *$7,800 per year.*

"Because our new AMESTEAM GENERATOR is entirely automatic, three firemen are now transferred to other duties. This results in an additional saving of *$7,200 per year.*

"This total saving of *$15,000 per year* does not include the considerable savings in maintenance costs. On top of this, the new Ames installation increases our production potential by 20% to 30% ... with much higher quality steam."

We at Ames continually receive letters like this from the enthusiastic users of AMESTEAM GENERATORS. Ames customers are *satisfied* customers. They know that when they buy AMESTEAM GENERATORS, they buy LOWER-COST STEAM!

What's **Your** Steam Problem?

If you need 10 to 600 HP and want the kind of space-saving, trouble-free service enjoyed by satisfied users of AMESTEAM® GENERATORS, contact your nearby AMESTEAM Dealer or write for our Catalog.

AMES IRON WORKS INC.
BOX M-18 OSWEGO, N. Y.

AMES IRON WORKS
BOX M-18, OSWEGO, N. Y.

Gentlemen:
Please send me further information on AMESTEAM GENERATORS and name of nearest representative.

NAME .....

COMPANY .....

ADDRESS .....

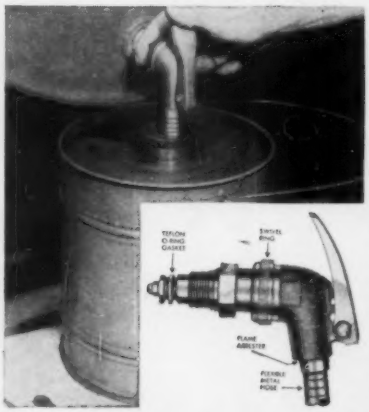
For more facts circle 512 on Reply Card

FLAMMABLES ENGINEERING BY PROTECTOSEAL

FLAMMABLES CONTROL METHODS AND PRACTICES IN PRODUCTION, PROCESSING AND IN MAINTENANCE

PUBLISHED BY THE PROTECTOSEAL COMPANY, CHICAGO, ILLINOIS • WAREHOUSES: CAMDEN, N. J.; LOS ANGELES, CALIF.

Fire-safe economies in dispensing flammable liquids from drums

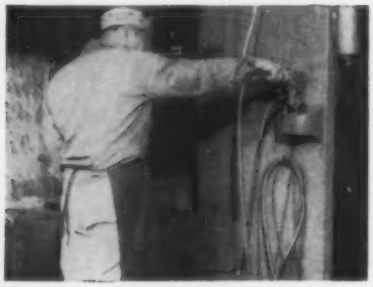


Fire-safe, controlled dispensing...no waste solvent . . . no spillage . . . accurate, measured flow . . . unauthorized withdrawal of liquids prevented . . . with Protectoseal Underwriters' Laboratories Approved Safety Drum Transfer Pump. Three fire baffles built-in at critical points. Result — flammable liquids dispensed economically, quickly, with protection against fire and explosion.

No more leaky drum faucets... where faucet connects with drum or from faulty, dripping valve seat . . . with Protectoseal Factory Mutual Approved Safety Drum Faucet. Self-positioning spout on swivel avoids stripped threads . . . Teflon O-Ring gasket universally impervious to all solvents . . . no distortion, shrinking or deterioration. No damage to valve seat because of its location at inlet end of faucet. Built-in fire baffle prevents flashbacks...flexible metal hose attachment forms static-free ground. Result—flammables dispensed safely . . . far longer service life.

For Further Information
Request Drum Dispensing File No. 69

Prevent spray gun clogging . . . cut lost production time . . . avoid excessive maintenance costs



Spray gun nozzle held securely in liquid solvent when not in use . . . prevents paint hardening . . . keeps spray gun openings free. Spray gun packing and lubricating oils protected . . . fewer parts replacement . . . solvent guarded from fire by metal fire baffles over gun port openings.

Result—spray guns always ready for instant use.

Large automobile manufacturer reports—"saves 4 hours spray gun cleaning time daily."

For Further Information
Request Spray Gun Receiver File No. 59

Automatic washing of spray masks . . . more production . . . less spoilage

Paint spray masks washed while operator continues production line work . . . masks always clean and ready for instant use. No production part spoilage or lost time due to dirty, inaccurate spray masks. Cleaning solvent protected by fusible link which automatically closes cover to snuff out fire.

For Further Information
Request Automatic Spray Mask Washer File No. 73

"Little Helper" safely speeds core-box cleanups

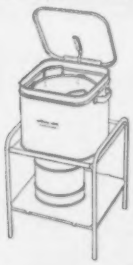
Foundry production speeded . . . fewer imperfect cores. Sand, oil and

dirt deposits removed faster—easier. Special container safely stores cleansing solvent . . . feeds brushes, wiping cloths fast. No chance of fire . . . no waste solvent . . . no hazardous spillage.

For Further Information
Request Plunger Can, Bench Can Dispenser File No. 50

Complete parts washing station takes only 2¼ sq. ft. floor space

Set beside production machines . . . includes work-high stand with large capacity safety wash tank and parts basket . . . 5-gallon safety storage can on shelf below provides instant auxiliary solvent supply. Self-closing wash-tank cover with fusible link attachment closes instantly in presence of fire. Production parts cleaned safely, thoroughly and drained at one location . . . in minimum floor space.



For Further Information
Request Parts Washing Station File No. 74

AT YOUR SERVICE . . .

Specialized experience in flammables engineering from Protectoseal Field Engineering Service. Provides practical ideas and safe cost-saving hints on storage, handling and use.

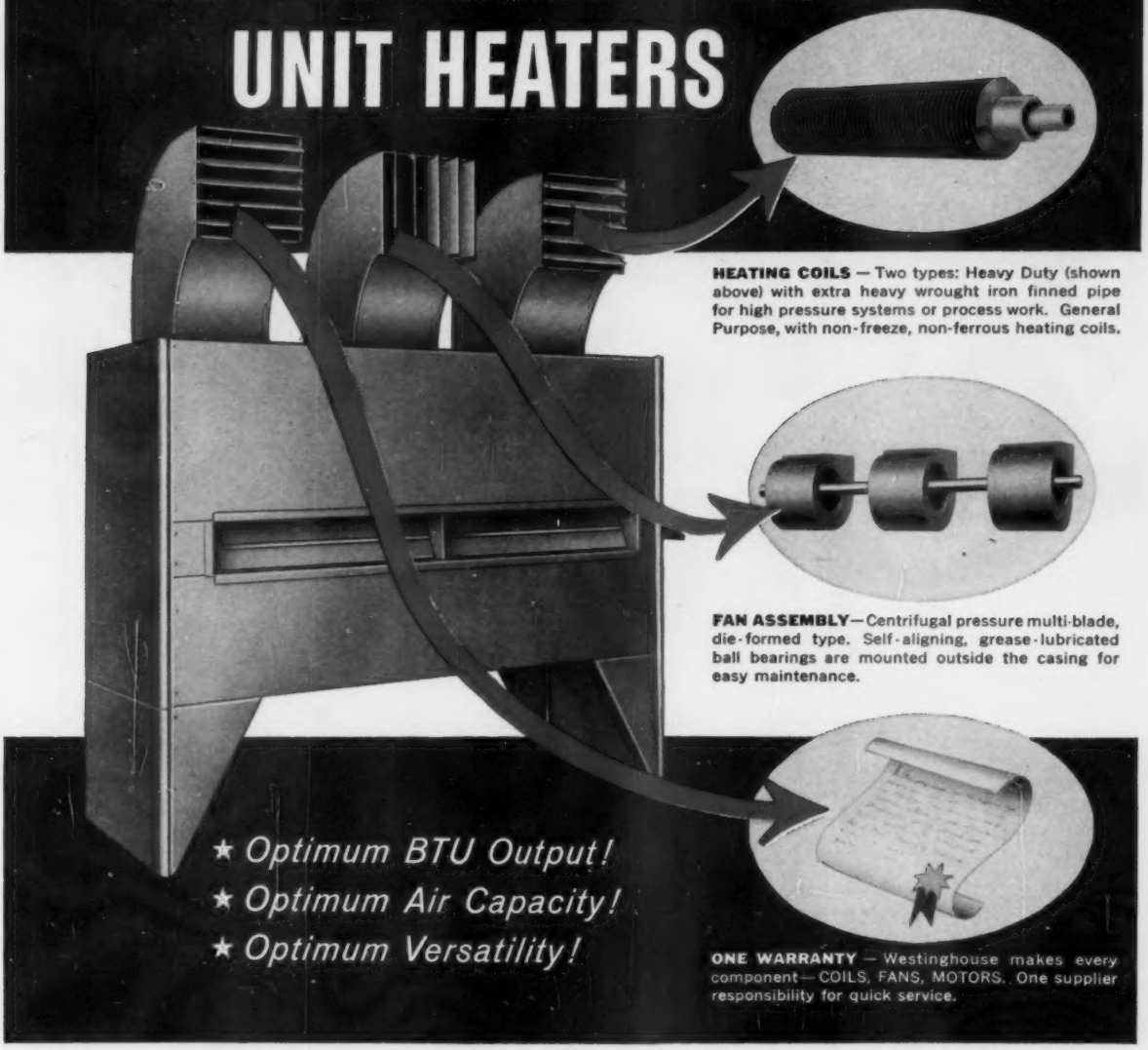
"Dave" Anschicks serving Illinois and Wisconsin

THE PROTECTOSEAL COMPANY
1942 So. Western Avenue, Chicago 8, Illinois
In Canada: Safety Supply Co., Toronto

For more facts circle 513 on Reply Card

An Exclusive Design for Industrial Applications...

WESTINGHOUSE INDUSTRIAL UNIT HEATERS



HEATING COILS — Two types: Heavy Duty (shown above) with extra heavy wrought iron finned pipe for high pressure systems or process work. General Purpose, with non-freeze, non-ferrous heating coils.

FAN ASSEMBLY—Centrifugal pressure multi-blade, die-formed type. Self-aligning, grease-lubricated ball bearings are mounted outside the casing for easy maintenance.

★ *Optimum BTU Output!*
★ *Optimum Air Capacity!*
★ *Optimum Versatility!*

ONE WARRANTY — Westinghouse makes every component—COILS, FANS, MOTORS. One supplier responsibility for quick service.

Fourteen basic coil sizes are available to give you optimum (most favorable selection) for either steam or hot water; up to 200 PSIG from 100,000 to 4,000,000 BTU/hr; air capacity for effective circulation, 2,000 to 34,000 CFM.

Sturdy casings, heavy-duty bearings and Westinghouse proven-plate fin-coil construction and performance give you a product to meet your most exacting application requirements.

You can't buy more rugged *quality* and *versatility* than is built into the Westinghouse line of unit heaters, designed *exclusively* for industrial applications.

Further, compact Westinghouse units can be mounted on the floor, wall or ceiling, can be relocated to accommodate changes in plant layout. And every unit is backed by a Westinghouse exclusive—*one warranty*—for engineering assistance and single equipment responsibility.

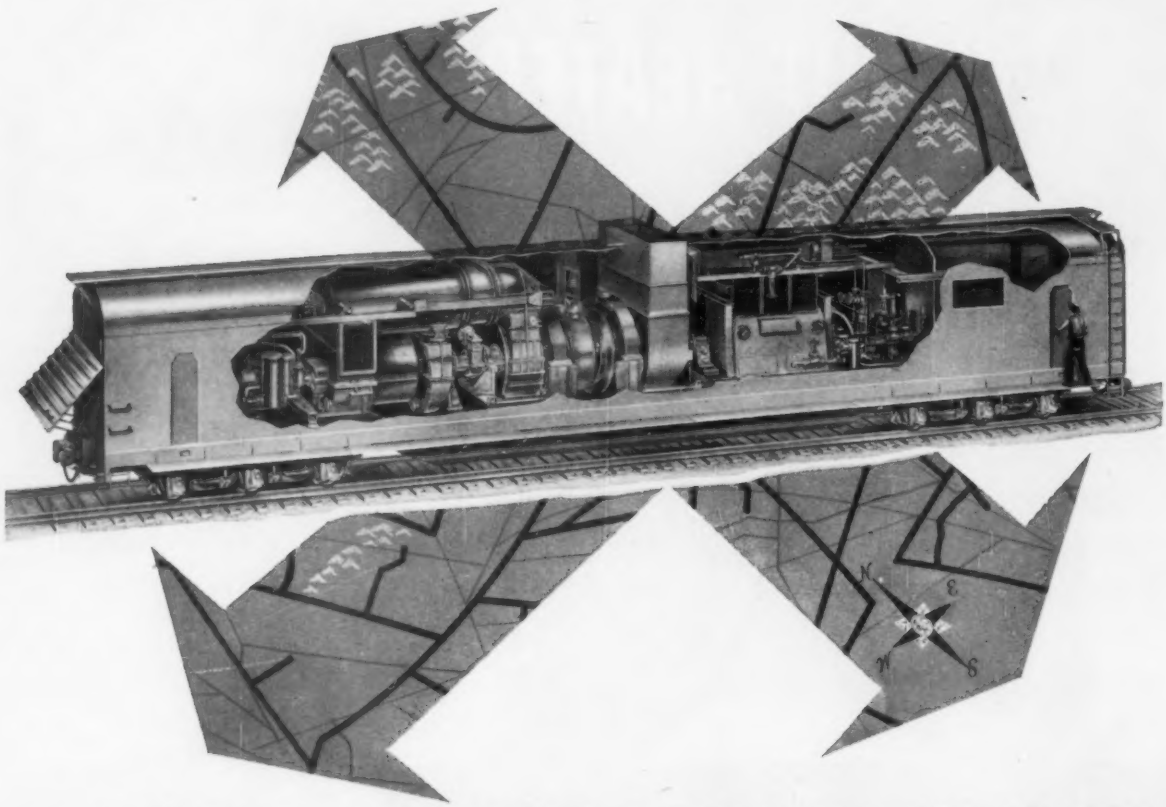
Next time you buy or specify Industrial Unit Heaters, call your Sturtevant Division Sales Engineer. For your copy of Industrial Heater Catalog 1510-2, call him now or write Westinghouse Electric Corporation, Dept. A-9, Hyde Park, Boston 36, Massachusetts.

J-80637

YOU CAN BE SURE...IF IT'S Westinghouse

For more facts circle 514 on Reply Card

KILOWATTS



...where and when you need them

Heavy temporary electrical loads out at the end of the line present a serious problem to most electrical utilities particularly when the industry served is an important one.

There is, however, a practical answer to peak loads or emergency needs . . . the Clark Turbo-Mobile Power Plant. This gas-turbine-driven unit is a completely self-contained, rail car mounted, generating station. Burning liquid or gaseous fuels, it can generate up to 6,750 KW, measured at the generator terminals, anywhere that there are railroad tracks. And whether the "temporary" demand lasts for a day or a year doesn't matter. The Clark unit is designed for continuous 24 hour a day service for as long as required.

Stationary gas-turbine-driven generating units can also be provided. When equipped with a regenerator, a thermal efficiency of 29% is achieved at a KW output of 6,200. When used in a combined cycle, with the exhaust gases generating steam in a waste heat boiler, up to 10,000 KW can be generated at a thermal efficiency of 29%. Both efficiencies are based upon the fuel's low heat value.

Clark engineers are available to analyze your specific applications with regard to portable or stationary gas-turbine-driven generating equipment. Consult your nearest Clark representative.

CLARK BROS. CO., OLEAN, NEW YORK
One of the Dresser Industries
Offices in Principal Cities Throughout the World

CLARK **Portable Generating Equipment**

For more facts circle 515 on Reply Card

BULLETINS just released and of immediate plant interest

MECHANICAL POWER TRANSMISSION

101 Speed Reducers—Standard styles and sizes of double-reduction speed reducers in ratios ranging from 75:1 to 4900:1 are covered in 20-pp Catalog CD-230. Dimensional diagrams are included, as well as a specifications arrangement which makes it simple to select reducer of exact capacity, type and ratio desired. Cone-Drive Gears Div., Michigan Tool Co.

102 Speed Variators—Bulletin GEA-6643, 16 pp, illustrated in full color, describes company's line of packaged direct-current adjustable speed drives available from 3 through 150 hp, 220, 440, 550 v, three-phase a-c 60 cycle. Included is a power data slide rule for calculating case dimensions, horsepower, speed range, power unit weight, motor frame size. General Electric Co.

103 Specialized Drives, Motors—Twelve-pp Bulletin A-2400 covers in text and illustrations this company's specialized drives and motors engineered to rigid specifications. Covered are integral a-c motors to 400 hp; d-c units to 1000 hp; d-c and a-c generators and motor-generator sets; gear-motors and variable-speed drive systems and their control. Reliance Electric and Engineering Co.

104 Silent Chain Drives—Book 2425 is a comprehensive 88-pp book containing detailed engineering data and illustrations of silent chain's versatility. Contains tables of service factors, ratings, chain length and center distance computations. Pre-engineered stock drives are listed in one 16-pp section. A 22-pp section of book outlines procedure for selection of engineered drives. Another section on drive components lists available chain widths; chain and wheel dimensions; wheel tolerances. Book is available to qualified plant engineers; please state your job title when requesting it. Link Belt Co.

105 Worm Gear Speed Reducers—Forty-pp Bulletin J13 features detailed technical data on company's line of worm gear speed reducers for a variety of industrial applications. Booklet describes various worm gear reducer designs with horsepower ranging from less than 0.1 to 121. Numerous drawings and specification tables show designs and ratings for the standard units available. Hewitt-Robins, Inc.

106 Flexible Couplings—Bulletin 99 describes applications of company's semi-floating shaft couplings for radial loads such as V-belts, chains, generator or motor armatures. Photos, drawings and diagrams illustrate details of design and operation. Thomas Flexible Coupling Co.

107 Clamps, Couplings, Joints—This product folder contains a number of individual bulletins on company's line of band clamps, V-band couplings and joints. Each bulletin contains detailed information on applications, sizes and dimensions, as well as photos, dimensional diagrams, installation tips. Marman Div., Aeroquip Corp.

PUMPS

108 Twin Screw Pumps—Technical Bulletin 255 features twin screw pumps (type TS) for non-corrosive liquids of wide viscosity range at pressures up to 350 psig and capacities to 550 gpm. Selection nomograph, outline dimensions, sectional drawing, and details of design and construction are provided. Warren Pumps, Inc.

109 Sump Pumps—Catalog E-101 describes company's non-clog sump pumps for drainage, underpass service, sewage disposal and other applications. Included are design and construction details, accessory photos and descriptions, and performance data. Cutaway drawing shows principal features. Economy Pump Div., C. H. Wheeler Mfg. Co.

110 Sand and Slurry Pump—Bulletin 601 gives complete specifications for a sand and slurry pump which is lined with replaceable and interchangeable hard metal and rubber liners. Cross-sectional view shows construction details and includes parts list, as well as dimensional diagram. Krogh Pump & Equipment Co., Inc.

GASKETS, SEALS

111 Spiral-Wound Gaskets—Bulletin AD-104, 12 pp, on company's spiral wound metal gaskets details outstanding features and design factors of the metal gaskets as well as types available for specific applications. Sizes are listed and charts for suggested sizes in relation to pressures sealed are included. The Garlock Packing Co.

112 Rotary Seals—Bulletin ML-177, 6 pp, describes functions and applications of company's Rotorseals, used as a means of transmitting air, liquid or gases under pressure, or vacuum from a stationary source into a rotating shaft. It also includes data on quick release valves, used to provide quick evacuation of pressurized air from pneumatic systems. Fawick Airflex Div., Fawick Corp.

VALVES, PIPING AND ACCESSORIES

113 Solenoid Valves—Form VS-51 contains condensed information on solenoid valves and electromagnetic control for industrial applications. Categories covered under solenoid valves include two-, three- and four-way, corrosion resistant, manual reset and special valves. Automatic Switch Co.

114 Quarter-Turn Valves—Sixteen-pp Reference Book 39, Section 3, describes and illustrates company's Lever-Seald quarter-turn plug valves, covering their operating principle and advantages. Dimensional data is provided on straightway models in semi-steel, cast steel and brass, also on three- and four-way and multiple-port valves. Homestead Valve Mfg. Co.

116 Steel Gate Valves—This bulletin on cast steel gate valves, lists 10 features, stressing durability, easy maintenance and erosion-resistance. Also provides dimension and weight charts and line drawings for each type. A large cutaway drawing illustrates design features. Walworth Co.

117 Plastic Valve—Catalog 42.0 contains essential data on company's all-plastic gate valve, designed for conveying corrosive and abrasive liquids in lines that must be chemically free of contamination. Cutaway views showing design and construction advantages are included. Sizes, dimensions and a graph of flow characteristics provided. Vanton Pump & Equipment Corp.

118 Cut-In Valves—Bulletin W-14 describes company's cushioned emergency cut-in valve which automatically opens to emergency water supply when normal water supply is interrupted either from outage of electrical power or mechanical failure causing pump shut-down. Schematic drawings of installation, dimensions are included. Golden-Anderson Valve Specialty Co.

119 Welded Steel Pipe—Eight-pp Bulletin SWP-14457 describes welded steel pipe for industrial use in diameters from 6 to 36 in., wall thicknesses to ½ in. Applications covered are plant piping, process piping, water supply and sewage disposal. Advantages are listed and pressure design data, dimensions and properties included. Also covered are fittings. Armco Drainage & Metal Products, Inc.

120 Stainless Tubing, Pipe—Technical Data Card 188 provides comparative price data for those responsible for the specification and procurement of seamless stainless pipe and tubing. Furnishes analysis details and comparative price ratios of 33 seamless stainless grades using Type 304 (18-8) as a base. Tubular Products Div., The Babcock & Wilcox Co.

On pages 213-214 are two postage-free Reader Service Cards provided for your convenience in ordering these bulletins. You may also use the cards to order any literature mentioned in ads.

121 Pipe Joint Wrap—Featuring Duratape and Duramesh pipeline joint wraps, Form MDT-5 contains descriptions of physical and chemical properties of both coal tar and asphalt-impregnated glass fiber products. Also includes photos of typical hand wrap applications. L.O.F. Glass Fibers Co.

122 Hot-Pipe Insulation—Advantages of an underground pipe insulation system in which an insulating concrete is poured directly and mono-

BULLETINS

(Begins on page 21)

lithically around underground hot pipes are detailed in this 12-pp folder. Among information furnished are thermal and structural characteristics, control of pipe expansion, sequence of installation, and specifications. Z-Crete Div., Zonolite Co.

VENTILATING AND AIR CONDITIONING

123 Centrifugal Fans—Bulletin 257, 32 pp, gives engineering data on company's BC Airfoil fans and illustrates construction details of fans for all types of ventilating and air conditioning installations. Comparative performance graphs show why greater efficiency and quieter operations are obtained. Capacity tables, dimensional drawings and suggested application arrangements are given for each model. Also included are rating tables, sample fan specifications, laws of fan performance. Ilg Electric Ventilating Co.

124 Inductor Air Conditioners—Bulletin 8827, 16 pp, describes inductor air conditioners for perimeter air conditioning of multi-storied buildings. Outlines and illustrates features and characteristics, covering such supplementary information as installation, adjustments and controls. Table of basic unit ratings, primary air rating curves, heating and cooling capacity indices, a table of gravity heating capacities, coil water friction values, pressure drop curves for orifice size selection are included. American Blower Div., American-Standard.

125 Duct Insulation — Engineering data and application instructions for spun mineral wool duct insulation, for application to heating and air conditioning ducts up to 450 F, are presented in this bulletin. Thermal conductivities and sound absorption coefficients are tabulated. Physical, chemical, mechanical and handling properties covered. Baldwin-Hill Co.

ELECTRICAL

127 Synchronous Motors — Features and applications of company's large high-speed synchronous motors and company services that go with them are described in 8-pp Bulletin GEA-6620. Photos illustrate designing and manufacturing facilities and large cutaway drawings give X-ray view of the horizontal and vertical motors of 1,500 hp and up. General Electric Co.

128 Distribution Transformers—Bulletin 137, 12 pp, describes four major types of dry-type distribution transformers and includes detailed engineering data. Photos, drawings, mounting diagrams and voltage ratings are given. R. E. Uptegraff Mfg. Co.

129 For Power, Lighting — Company's Type RR cable for many types of installations—indoor, bus or conduit, aerial, buried—are presented in this bulletin. Gives sizes for both shielded and non-shielded types. Stresses construction of the cable, describes insulations available. Triangle Conduit & Cable Co., Inc.

130 Mineral Insulated Cable — This 12-pp brochure describes the merits of safety mineral insulated cable as well as its electrical and physical properties. Installation and wiring data are included, as well as numerous photos, drawings and diagrams showing features. General Cable Corp.

131 Cable Supports—This information folder contains data on company's cable supporting equipment, telling how to install cable supports, as well as pointing out advantages of using cable trough. T. J. Cope Div., Rome Cable Corp.

132 Force Control Switches — This illustrated bulletin describes a complete line of force control switches, designed for controlling mechanical forces electrically. Lists specifications and includes dimensional diagrams. W. C. Dillon & Co., Inc.

133 Instrument, Control Switches—Construction features of company's instrument and control switches and their advantages are described in 8-pp Bulletin 14B 8112A. Includes operational information, a description of various components, dimensions of modern, heavy duty, removable handles. Allis-Chalmers Mfg. Co.

134 Parallel-Plate Capacitors — Bulletin GEC-1482 discusses application of high-frequency parallel-plate capacitors in induction heaters where they are used in parallel resonant or tank circuits. Includes performance data on 12 separate ratings, outline drawings of dimensions, and characteristic curve. General Electric Co.

135 Germanium Rectifiers—Bulletin GEA-5773C, 6 pp, tells how to select and apply fan-cooled and blower-cooled germanium rectifiers. Tables, charts, line drawings, and photos are included to tell the story of parallel and series operation, to indicate operating characteristics, to give dimensions, ratings and model numbers. General Electric Co.

136 Basic-Truck Electricity—Fundamentals of battery power for industrial trucks are covered in this question-and-answer form bulletin. Illustrations, line drawings and graphs clarify battery essentials. Exide Industrial Div., The Electric Storage Battery Co.

LIGHTING, COMMUNICATION

137 Lighting Equipment — Bulletin 2697, 52 pp, contains detailed information on a line of lighting equipment, including floodlights, searchlights, industrial lighting and fixture condulets. Two new items—mercury vapor floodlights and vapor master lighting fixtures—are also covered. Description of each item is given along with list price. Crouse-Hinds Co.

138 Luminous Ceilings — Catalog C-57, 60 pp, features a visual index of 13 basic models of luminous ceilings with which innumerable combinations of types, materials, designs, and color patterns can be created. Almost 60 pp of details follow, including layout details for countless designs and factual data on dimensions and light distribution. The Wakefield Co.

139 Small Lamp Sockets — Catalog S-557, 28 pp, contains technical descriptions of sockets for small lamps, with actual-size illustrations of various designs. Each group of sockets has a page of diagrams with measurements of some mounting brackets available. Leecraft Mfg. Co., Inc.

140 Loudspeakers—This 12-pp illustrated catalog describes public address and high fidelity loudspeakers for commercial and industrial use. Specifications and application information, as well as prices, are incorporated. Included are paging and talk-back speakers, heavy duty trumpets and driver units. University Loudspeakers, Inc.

MATERIALS HANDLING

142 Materials Handling Ideas—The current issue of "Materials Handling Illustrated" features photo-stories which outline in detail various handling problems and their solution related to use of company's fork lift trucks and material carriers. Each article compares "old" vs "new" techniques employed. Towmotor Corp.

143 MH Cost Reduction—Bulletin 52, on cost reduction in materials handling, details advantages of an overhead system of metal enclosed trolley busway electrification for cranes, hoists, stackers, conveyor lines and warehouse lighting. Pictures applications where safe electrification is as important as handling equipment Feedrail Corp.

Reader Service Cards for ordering bulletins are on pages 213-214. Be sure to include your name, job title, and company, even if you want bulletins mailed to your home address.

144 Electric Fork Truck—These two brochures—one covering specifications and drawings, the other a pictorial descriptive bulletin—introduce company's Elbolift electric fork lift truck. Advantages of design and operation are detailed. Automatic Transportation Co.

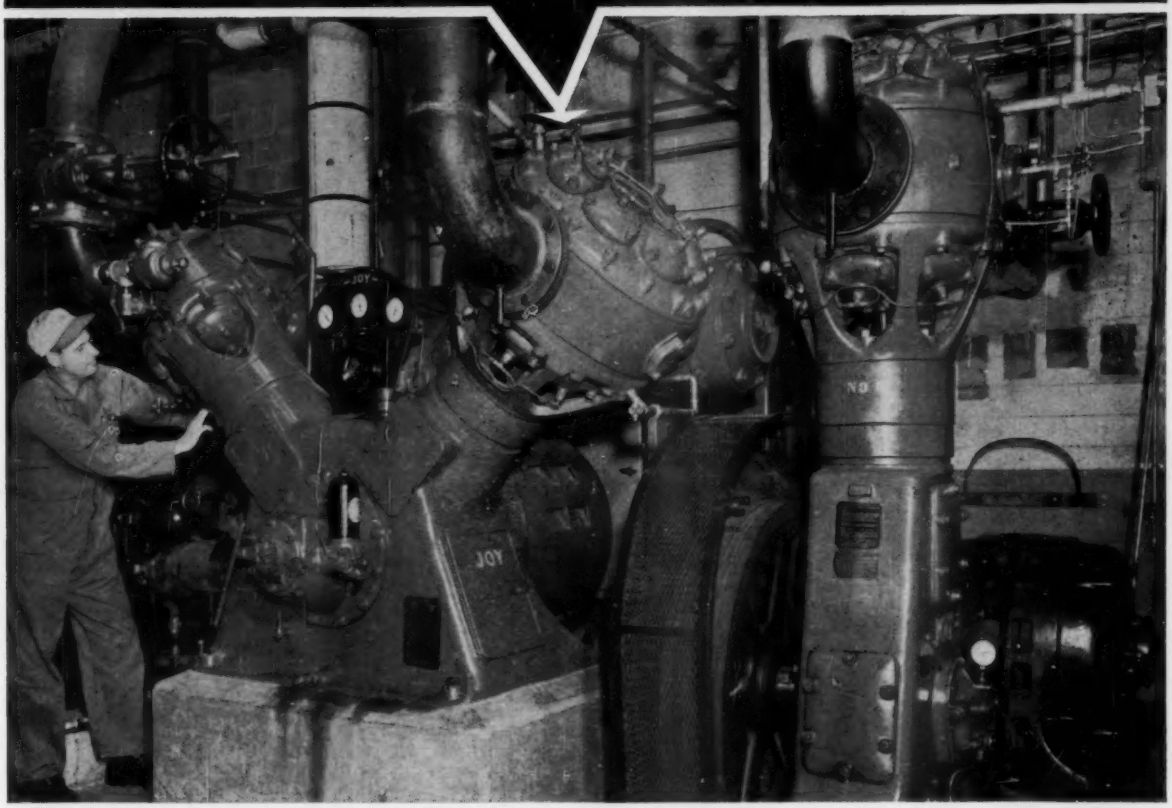
145 Adjustable Ramps—Bulletin Ref. 1-169-57, 8 pp, illustrates and describes a line of powered adjustable ramps for loading docks. Covers non-floating, manual floating and automatic floating models of Adjust-A-Dock, an hydraulic dock leveling device with capacities from 10,000 to 20,000 lb. Detailed specifications are provided. Rowe Methods, Inc.

146 Parts-Handling Baskets — A wide range of wire parts-handling baskets for conveying and processing production parts are described in 8-pp Bulletin MS-57. Also shown are conveyor hooks, plating racks and many special purpose materials handling items. Wire and Iron Products, Inc.

(More Bulletins on page 215)

They Needed More Oil-Free Compressed Air But Had Limited Space

A Third Joy Unit Solved it!



A West Coast Company needed more oil-free compressed air . . . in a hurry! However, there just wasn't any space in the boiler room for additional machines. They had been operating two Joy WG-9 OL vertical compressors (the machine at right in the photo). These non-lubricated compressors had run continously . . . 24 hours a day . . . for *17,000 hours with no down time.*

So they again called Joy in on the problem. The solution: One WG-9 OL with 75 hp was taken out and replaced with a Joy WN-112 E-OL rated at 150 hp. This 974 cfm machine supplies plenty of air for the new equipment, yet is compact enough to fit into the small space available.

If you need oil-free air take advantage of Joy's more than 25 years of experience with non-lubricated compressors. Write ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Co. (Canada) Limited, Gal, Ont.*

Write For FREE Bulletin 130-15

Consult a Joy Engineer

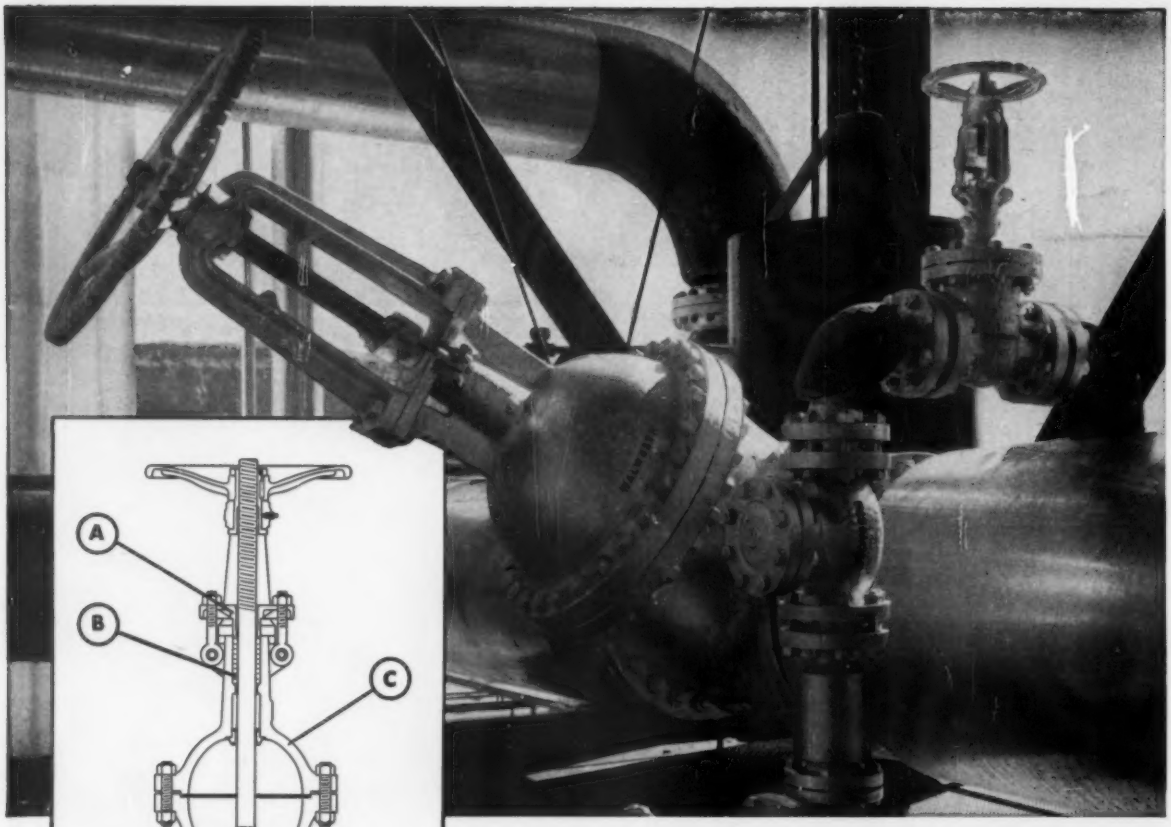
For Air and Gas Compressors, Vacuum Pumps and Boosters, Conveyors, Fans, Electrical Connectors.

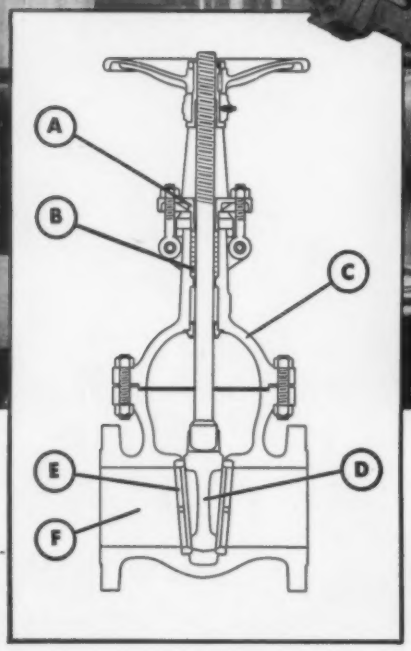
WBW 16307-130

JOY

SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1885

For more facts circle 516 on Reply Card





Walworth Series 150 and 300

CAST STEEL GATE VALVES OFFER YOU THESE FEATURES

for 'round-the-plant service

(A) GLANDS: Clearances between the gland and stuffing box, and gland and stem, are such that the stem cannot be scored even if the gland is pulled down unevenly.

(B) DEEP STUFFING BOXES: More than adequate in all sizes (2″ to 24″) to assure tightness and maximum packing life.

(C) BONNETS AND BODIES: Engineered to exceed the requirements of all applicable codes and standards. They are tough, durable, dependable.

(D) INTEGRAL GUIDE RIB FACES IN BODY: Machined to insure accurate centering of the gate.

(E) STURDY SEAT RINGS: Bottom-seated so that no recess exists at the back of the ring to cause turbulence, erosion and pressure drop.

(F) STREAMLINED PORTS: Permit unobstructed flow which results in minimum pressure drop and reduces the possibility of erosion.

Walworth Cast Steel Gate Valves can be furnished with either flanged ends or butt welding ends. Roller bearing yokes are available on the larger sizes. On valves 4 inches and larger, by-passes can be furnished. Walworth Cast Steel Gate, Globe and Check Valves from Series 150 to 2500, are available. For Series 600 and higher, we recommend Walworth Pressure Seal Cast Steel Valves. See your Walworth Distributor or write to Walworth for complete information.

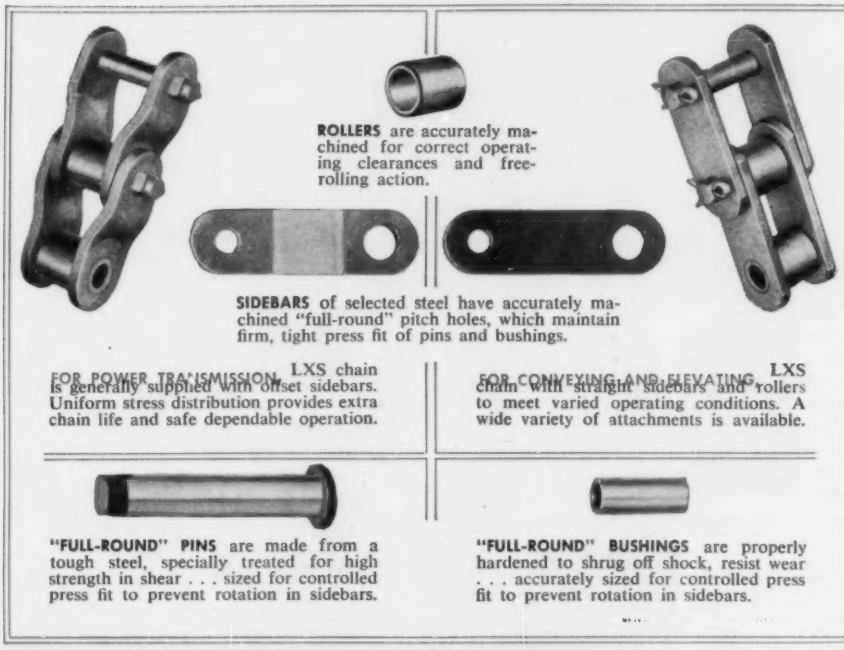
WALWORTH

60 East 42nd Street, New York 17, New York

SUBSIDIARIES: ALOYCO ALLOY STEEL PRODUCTS CO. CONOFLOW CORPORATION GROVE VALVE & REGULATOR CO.
SW SOUTHWEST FABRICATING & WELDING CO., INC. MH M & H VALVE & FITTINGS CO. WALWORTH COMPANY OF CANADA, LTD.

For more facts circle 517 on Reply Card

"Full-round" design of Link-Belt LXS chain avoids stress raisers



ROLLERS are accurately machined for correct operating clearances and free-rolling action.

SIDEBARS of selected steel have accurately machined "full-round" pitch holes, which maintain firm, tight press fit of pins and bushings.

FOR POWER TRANSMISSION, LXS chain is generally supplied with offset sidebars. Uniform stress distribution provides extra chain life and safe dependable operation.

FOR CONVEYING AND ELEVATING, LXS chain with straight sidebars and rollers to meet varied operating conditions. A wide variety of attachments is available.

"FULL-ROUND" PINS are made from a tough steel, specially treated for high strength in shear . . . sized for controlled press fit to prevent rotation in sidebars.

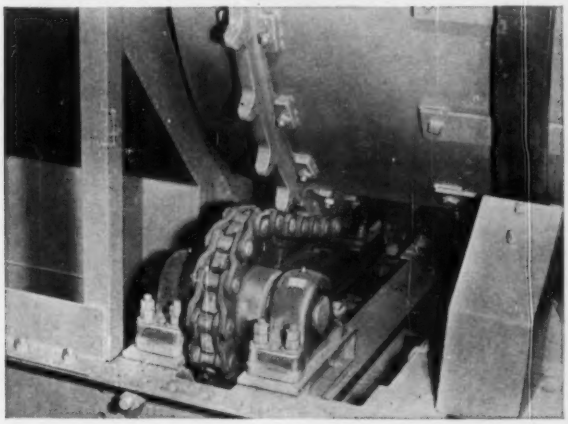
"FULL-ROUND" BUSHINGS are properly hardened to shrug off shock, resist wear . . . accurately sized for controlled press fit to prevent rotation in sidebars.

Greater live bearing area extends life

Stress concentration points are eliminated in Link-Belt LXS chain! "Full-round" design avoids sharp corners which may be the starting points of chain failure . . . provides maximum live bearing area between pin, bushing and sidebars. As a result, stress is distributed evenly . . . long chain life is assured under severe conditions.

Pins and bushings of LXS chain are accurately sized . . . assuring controlled press fits, preventing rotation in sidebars. Similar accuracy in machining of sidebars permits close control of pitch and proper chain length after assembly.

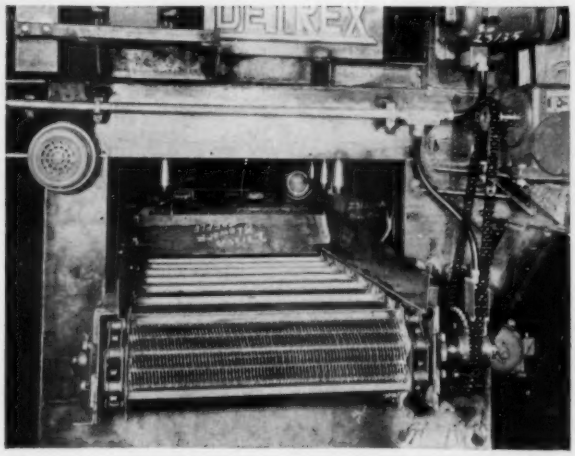
Other long-life features of Link-Belt LXS chain include use of selected steels and controlled hardening of all parts. Both contribute to greater endurance . . . greater uniformity.



LXS drives stand up to impact and abrasive service

Large, live bearing area makes LXS chain ideal for exposed drives and abrasive conditions such as found on this heavy rotating drum. Uniform distribution of load over ample bearing area reduces cutting action of abrasives . . . extends chain life.

LXS chain has stamina required for long, heavy-duty conveyors



With its exceptional strength and wear resistance, Link-Belt LXS chain can easily meet rugged conveying and elevating requirements. Due to accuracy of pitch and attachment spacing, plus close matching of multiple strands, LXS has the added strength and wear life necessary for the extra-long conveyors so important to today's highly mechanized industry.

HEADQUARTERS for chains, sprockets and other Link-Belt products is your nearby Link-Belt factory branch store or authorized stock-carrying distributor. Refer to the Yellow Pages of your local Phone Directory.

LINK-BELT

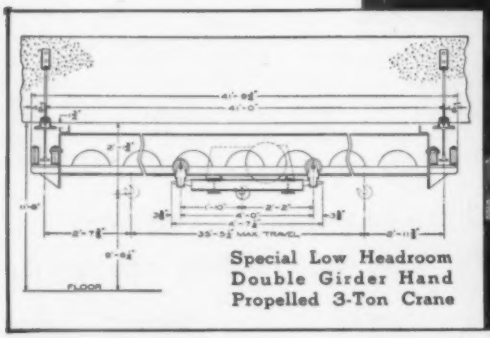
14,740

CHAINS AND SPROCKETS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

For more facts circle 518 on Reply Card

3 ton, 41'-0" span Cleveland Tramrail double-girder hand-propelled crane with electric hoist handling a heavy electrical machine.



Special Low Headroom Double Girder Hand Propelled 3-Ton Crane

Low-headroom Crane Enables 25% Production Increase

A MANUFACTURER of heavy electrical equipment ran against a serious production problem because of its rapid growth and inability to expand its building area.

An overhead crane was felt to offer a way of alleviating the situation. Conventional crane designs were studied, but they were unable to provide height of lift required by 24 inches or more.

The solution was found in a special Cleveland Tramrail crane of low-headroom design. This crane has two girders spread apart so the trolley can operate between them and also permit the hoist hook to be raised above the bottom of the girders.

Various lifting and moving jobs can be done easily, quickly and more safely with the crane. For instance, setting a heavy machine on a skid and preparing it for shipment, formerly required valuable man-hours; now with the crane, it only takes one-third of a man-hour—thus is done many times faster.

The tremendous increase in production made possible by the crane has astonished everyone. It enabled an increase in output by approximately 25 percent.

WRITE FOR FREE COPY of Engineering and Data Booklet No. 2008. Packed with valuable information. Profusely illustrated.

CLEVELAND TRAMRAIL

Overhead Materials Handling Equipment

CLEVELAND TRAMRAIL DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 7527 E. 290 ST. • WICKLIFFE, OHIO

For more facts circle 519 on Reply Card

Rolling Steel Doors

Manually, Mechanically or Electrically Operated

In truck openings, loading dock openings, and railroad openings, in modern plants and warehouses where the time element and operating space requirements are primary considerations, the rolling steel door has no equal . . . because, a quick-opening, quick-closing, power operated rolling steel door saves both time and space. The vertical roll-up action is fast—requires no usable space either inside or outside the opening. And there are no overhead tracks or other obstructions to restrict headroom and interfere with crane handling or stacking of goods or materials adjacent to the door opening. No other type of door can give you this space-saving compactness in operation . . . and no other type of door can give you the positive security, firesafety and permanence inherent in a good rolling steel door. The all-metal construction of a rolling steel door reduces maintenance to a negligible factor, and assures you a lifetime of continuous, trouble-free service. When you buy a rolling steel door, it will pay you to check specifications carefully . . . you'll find that Mahon doors are built better to give you better service over a longer period of time —for instance, the galvanized steel in Mahon curtain slats is BONDERIZED and DIP-COATED with Synthetic Enamel which is baked on at 350° F. prior to roll-forming. This is just one of the extra-value features of Mahon Rolling Steel Doors . . . comparison will disclose many others that add up to a much better door investment. See Sweet's Files for information or write for Catalogue G-57.

THE R. C. MAHON COMPANY • Detroit 34, Michigan

Sales-Engineering Offices in Detroit, New York and Chicago • Representatives in Principal Cities

Manufacturers of Rolling Steel Doors, Grilles, and Automatic Underwriters' Labeled Rolling Steel Fire Doors and Fire Shutters; Underwriters' Rated Fire Walls; Insulated Metal Curtain Walls; Electrified M-Floors; Acoustical and Troffer Forms; and Steel Roof Decks and Long Span M-Decks.

ROLLING STEEL DOORS, SHUTTERS AND GRILLES TO MEET EVERY REQUIREMENT

Shown above are Eight of Thirty-four Mahon Rolling Steel Doors installed in a new, modern building for the Giant Food Distribution Center, Landover, Maryland. Eighteen of these doors were installed in Double Truck Openings and Four in Railroad Openings. Stanford Construction Company, Inc., General Contractors.

M A H O N

For more facts circle 520 on Reply Card

MOUNTING GLAND
Eliminated
ON
CHEMPRO
"Wedge-Lock"
mechanical seals

The Chempro line of external "wedge-lock" seals does not require a mounting gland, or any modification to the stuffing box, to align and hold the Chempro seal in position. The patented "wedge-lock" design automatically seats the seal stator in the stuffing box in perfect face-to-face alignment with the seal rotor on the shaft. Simple and easy to install—*in only 20-30 minutes.*

OTHER ADVANTAGES

- Completely Interchangeable with Packing
- Simple in Design—Only 8 Parts
- Chempro Teflon* Shaft Packing—Chemically Inert
- External Seals Adjustable After Installation
- Parts Interchangeable Between Seal Styles
- External and Internal Seals Available—From Vacuum to 100 psi

*du Pont trademark

Write for Bulletins CP551 and 575

CHEMICAL & POWER PRODUCTS, Inc.

7 Broadway, New York 4, N. Y.

For more facts circle 521 on Reply Card

BACKTALK AND FORETHOUGHTS

Edited by Marjorie E. Weissman

Material for Electrical Course

PLANT ENGINEERING:

"We were impressed by an article entitled 'Series Motor Study' by Roger Fuller, which appeared in the March, 1957 issue of PLANT ENGINEERING.

"If at all possible, we would appreciate receiving 50 copies of this article to use in our electrical course here at Dunwoody Institute." *J. R. Tilbury, Head, Electrical Dept., The William Hood Dunwoody Industrial Institute, Minneapolis, Minn.*

► Our supply of tear sheets of this article has been exhausted, but Mr. Tilbury has our permission to reproduce the article by any process available, provided credit is given to PLANT ENGINEERING.—*Editors.*

Permission to Reprint

PLANT ENGINEERING:

"In the October, 1957 issue, pages 148 through 150, you published an article on the crane system used in our plant. The article is titled '21 Cranes—Each Tailored to Its Job.'

"We would like to obtain reprints of this article for our employees and for our salesmen. Therefore, will you kindly grant us permission to reprint this article." *Orville G. Thaler, Secretary-Treasurer, Precision Steel Warehouse, Inc., Franklin Park, Ill.*

► We are very pleased to give permission to reprint this material and request only a credit line.—*Editors.*

Better Than Perpetual Motion?

PLANT ENGINEERING:

"What happened to the extra 600 per cent of the water saved on page 54 of the October issue? Either a decimal point slipped or someone has finally stumbled on something better than perpetual motion.

"It sounds to us like the old gadgets offered for the Model T. Each one would save from 25 to 50 per cent of the gasoline, so if you installed five or six of them, you had to stop at every other filling station and drain the tank." *H. F. Penney, President, The Valley Machine Co., Wheeling, W. Va.*

► Really, it is getting so that an editor can't even drop a decimal point with impunity these days. Some bright-eyed reader is sure to notice and accuse us of things like discovering perpetual motion! Mr. Penney sure caught us on this one and we are glad he did.—*Editors.*

Criteria for Mechanics

PLANT ENGINEERING:

"When we decided to test our maintenance mechanics such as millwrights, pipefitters, electricians, carpenters, etc., to determine impartially and objectively their craft abilities, we thought it would be simple to find tests and normal standards to identify craft abilities. We had planned to use this information as one of the standards for upgrading, merit increases, etc. It is common to test weldors for welding ability and speed. It was our thought that this would be true for other crafts.

"Strange as it seems to us, this is not a standard practice and, in fact, we have been able to find little that will help us fabricate tests.

"We would very much appreciate your comments concerning this endeavor and any help you would be so kind as to offer." *D. M. Brown, Manager-Facilities, Flight Propulsion Laboratory Department, General Electric Company, Cincinnati 15, Ohio.*

► We have been able to find one immediate source of information and are working on one other possibility. The Science Research Associations, in Chicago, have a program of testing similar to that which Mr. Brown seeks. Miss Frances Murray, of their testing department, is sending information on their program. Another possible source is the Industrial Management Institute, University Extension Division, The University of Wisconsin, Madison, Wisconsin.—*Editors.*

Requesting the Old Ones

PLANT ENGINEERING:

"While I realize this edition is old, I should greatly appreciate two reprints of the following article, 'Select Couplings to Fit the Job' by J. W. Samzelius. This article appeared in your May, 1952 issue." *C. R. Mallory Smith, Koppers Company, Inc., Metal Products Division, Baltimore 3, Md.*

PLANT ENGINEERING:

"Enclosed is a page taken from your September, 1956 issue, describing the Wide-Lite.

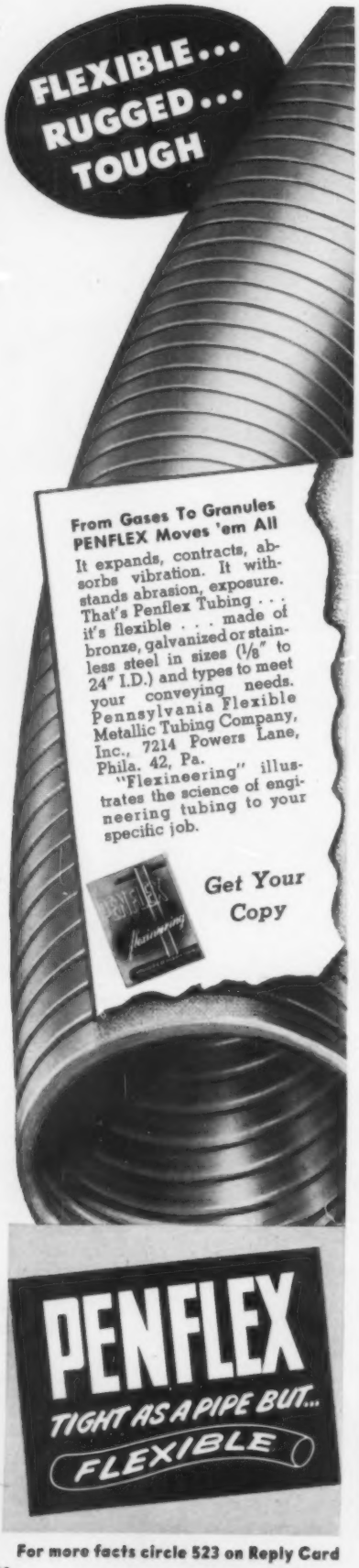
"If at all possible, please advise the

wherever your plant operating plans include water . . .

BETZ

CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

BETZ LABORATORIES INC., Philadelphia 24, Pa.


FLEXIBLE...
RUGGED...
TOUGH
From Gases To Granules
PENFLEX Moves 'em All
It expands, contracts, absorbs vibration. It withstands abrasion, exposure. That's Penflex Tubing . . . it's flexible . . . made of bronze, galvanized or stainless steel in sizes (1/8" to 24" I.D.) and types to meet your conveying needs. Pennsylvania Flexible Metallic Tubing Company, Inc., 7214 Powers Lane, Phila. 42, Pa.
"Flexineering" illustrates the science of engineering tubing to your specific job.
Get Your Copy
PENFLEX
TIGHT AS A PIPE BUT...
FLEXIBLE
For more facts circle 523 on Reply Card

BACKTALK— FORETHOUGHTS

name of the manufacturer so that we can secure full information. We are particularly interested in the installation of this light for two large industrial buildings which we have." *J. E. Davis, Williams and Davis Boiler and Welding Co., Inc., Dallas, Texas.*

▶ The manufacturer of this equipment has been notified of Mr. Davis' interest in more information.—*Editors.*

Equipment Repairs

PLANT ENGINEERING:

"On pages 138 and 139 in the September, 1957 issue of PLANT ENGINEERING, is an illustrated article by R. L. Rectenwald that explains the repair of equipment by the stitching process. Would you please inform us as to where we could obtain additional information concerning this operation?" *Donald Young, Supervisor of Equipment, The Cincinnati Milling Machine Co., Cincinnati, Ohio.*

▶ Readers interested in receiving more information on this process should write to the author, who is president of the Maintenance Engineering Corp., P.O. Box 10426, Pittsburgh 34, Pa.—*Editors.*

Latest in Billet Grinders

PLANT ENGINEERING:

"In the July issue of PLANT ENGINEERING, News from the Plants section, page 144, advantages of a new hydraulic-electric billet grinder over a conventional swing grinder are briefly explained. The discussion fails, however, to note the manufacturer of this new type of grinder.

"Any further information which you could supply on this phase of the subject would be greatly appreciated." *P. F. Walker, Mechanical Engineer, Bethlehem Steel Co., Inc., Bethlehem, Pa.*

▶ This request has been forwarded to the public relations department of Allegheny Ludlum Steel Corp., at whose Brackenridge plant the grinder installation was made. We are sure they will be glad to forward the name of the manufacturer to interested readers.—*Editors.*

Insulating Storage Tanks

PLANT ENGINEERING:

"In the September, 1957 issue of PLANT ENGINEERING, there was an article evaluating the economic factors of supplying heat to insulated versus uninsulated, above-ground product storage tanks. Unfortunately, I have mislaid my copy of this issue and I am inquiring whether it would be possible to obtain a tear sheet of the article." *W. H. Kreitzer, Division Engineer, Socony Mobil Oil Co., Inc., St. Louis, Mo.*

▶ This article was titled "Reduce Costs on Heating Bulk Storage Tanks." Tear sheets have been sent to Mr. Kreitzer with our compliments.—*Editors.*

He Liked Tax Article

▶ Mr. Gerver, author of the article "Figuring Taxes on Productive Assets," which appeared in the November issue, recently received the following comments about his article.—*Editors.*

A Provocative Article

Dear Mr. Gerver:

"The writer has just finished your article in the November issue of PLANT ENGINEERING.

"I have been responsible for the major taxation and recovery schedules for this plant since 1935, and this is the most provocative of extensive thought and study of any similar analysis yet to be presented to us.

"We certainly thank you, and would appreciate the opportunity to study your further comment if and when published." *M. A. Hagerman, Crystal Refining Company, Carson City, Michigan.*

More Info on Flooring Article

PLANT ENGINEERING:

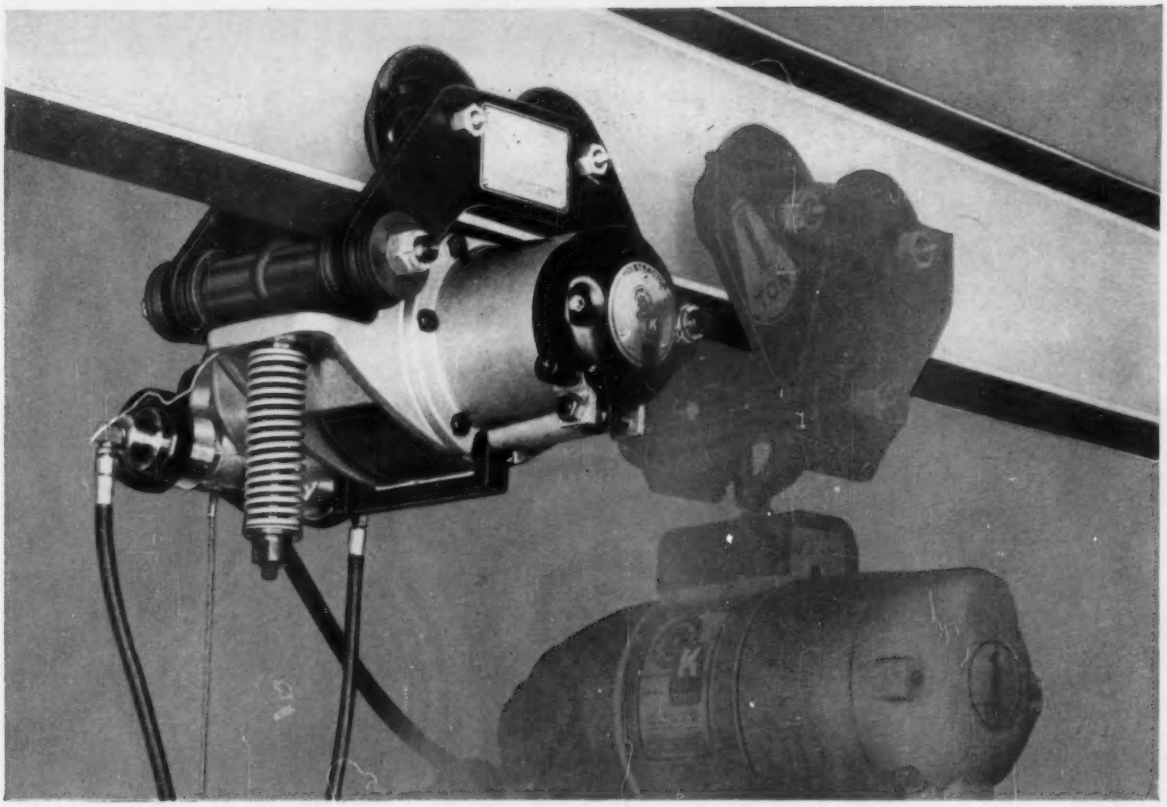
"We would like to have more information about the flooring material —Monile—which was described in your October, 1957 issue.

"We are especially interested in its resistance to mild sulphuric acid solutions." *W. C. Sandlin, The Russell Manufacturing Co., Alexander City, Alabama.*

PLANT ENGINEERING:

"Would you kindly send us additional information about Monile. We would also like to know if the manufacturer recommends using this product on floors with a heavy salt condition." *Alford Soley, Plant Engineer, Blitz-Weinhard Company, Portland 9, Oregon.*

▶ The names of these readers and their specific problems, along with the many other inquiries we have received, have been forwarded to the manufacturer of the flooring material, Master Mechanics Company, Cleveland, Ohio. —*Editors.*



New HOISTRACTOR adds push-pull power to any beam hoist

Now, it's an easy one-man, one-hand operation to raise, lower and move loads up to two tons. Simply use Gardner-Denver's new Keller "Hoistractor." This air-powered hoist trolley—connected to any beam hoist by a drawbar—rides the same beam as the hoist. Hoist lifts and lowers . . . "Hoistractor" moves hoist and load along the beam.

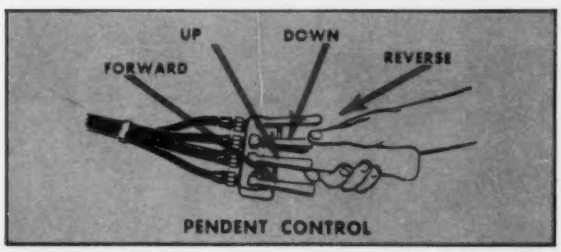
This new tractor unit simplifies moving heavy loads to truck, stock bin, machine tool or dip tank. Now, one man handles jobs such as these with greater speed and safety—without fatigue.

Powered by an axial-piston type air motor, the powerful, lightweight "Hoistractor" exerts 250-lb. drawbar pull on a beam. Speed is variable from slow creep to full-load speed of 70 ft. per min., with a no-load speed of 150 ft. per min.

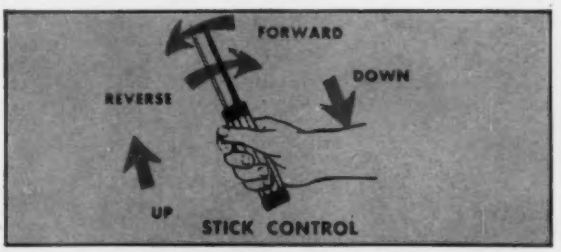
Sensitive air controls permit smooth acceleration and deceleration . . . accurate load spotting. Powerful enclosed mechanical brake, easily adjusted, provides positive, safe stopping.

Get all the facts on the new Keller "Hoistractor." Request Bulletin 87-1.

ONE-HAND CONTROL—TWO TYPES AVAILABLE



Squeeze hand grip has up-down operating levers for hoist and fore-aft levers for "Hoistractor."



Swiveled rod with four-way grip control. Raising or lowering the grip raises or lowers hoist load.

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois

For more facts circle 524 on Reply Card

HOFFMAN INSTALLATIONS PAY THEIR WAY AT ARMOUR & CO.

HOW HOFFCO-VEYOR SYSTEM IMPROVED PRODUCT ROUTING AT GLUE PLANT

before the installation of a money and labor-saving Hoffco-Veyor pneumatic system in this Armour & Co. glue plant, these were among their conveying problems:

1—Materials moved slowly, in uncontrolled quantities.

2—Bulky machines were used in product routing.

3—Raw materials escaped into the plant atmosphere.

4—Plant personnel was exposed to moving machinery.

5—Considerable manual labor was required to move materials between four separate processing floors.

HOFFMAN CONVEYOR SYSTEMS

after installation of a Hoffco-Veyor pneumatic conveying system, these improvements resulted:

1—Materials moved in controlled quantities.

2—One compact Hoffman system serves the entire plant.

3—Clean, dust-free pickup and delivery prevents leakage into plant atmosphere.

4—Working hazards were eliminated by enclosed equipment.

5—Materials move between separate processing floors automatically. Savings pay for equipment in short time.

custom designed for your needs

Ask your Hoffman representative to analyze your product routing problem or write for Bulletin PB500 . . . no cost or obligations.

Hoffco-Veyor Systems are a fast, inexpensive method of conveying sand, gravel, flour, cement, chemicals, granulated and pulverized substances.

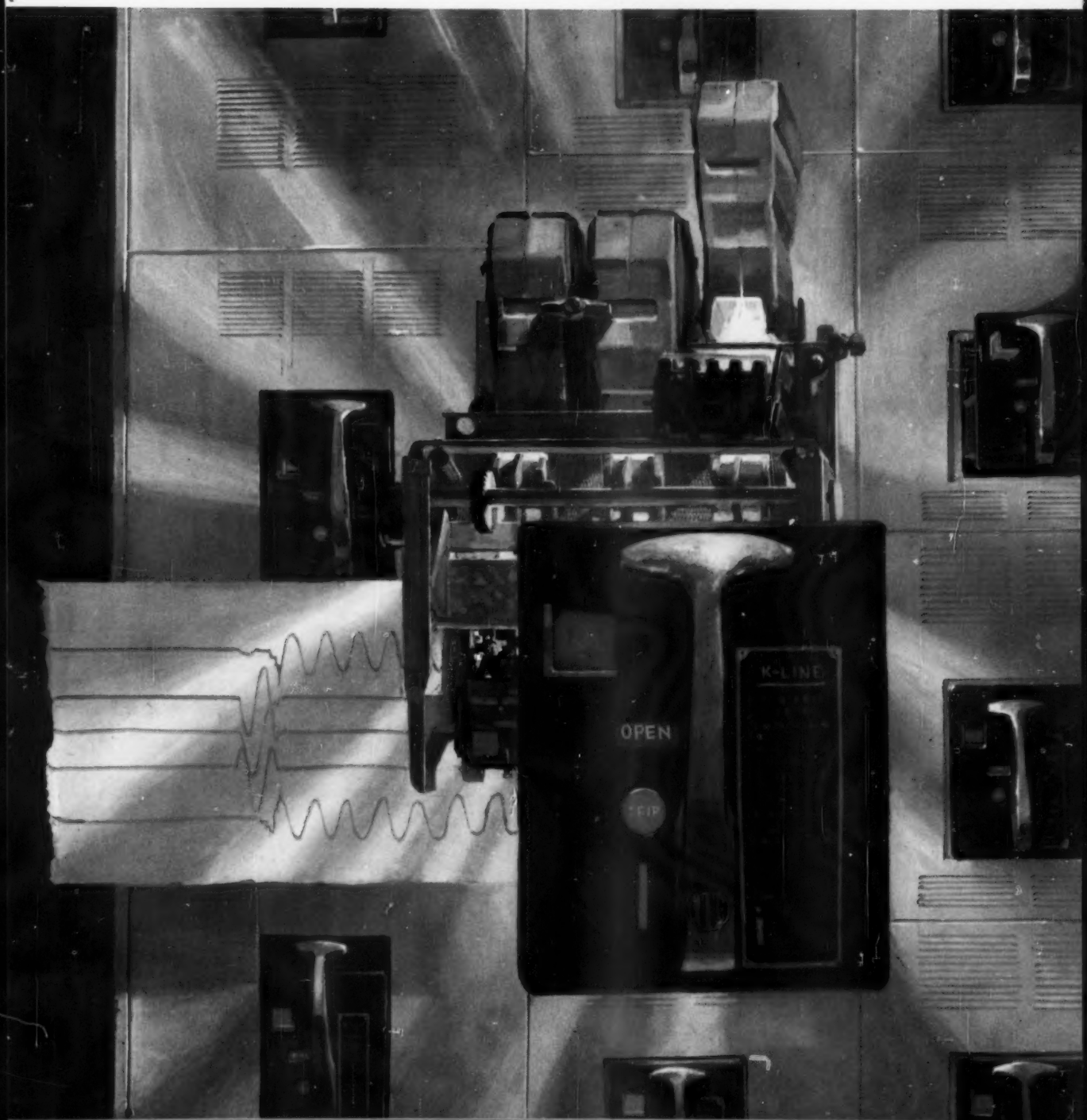
PNEUMATIC CONVEYING DIVISION **U.S. HOFFMAN MACHINERY CORPORATION** **103 FOURTH AVENUE, NEW YORK 3, N. Y.**

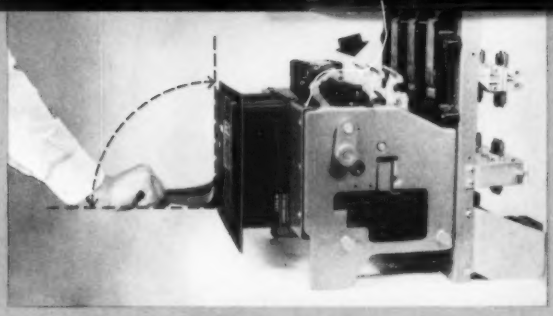
Other industrial equipment— **INDUSTRIAL FILTRATION DIVISION,** Machine Tool Coolant Clarifiers—Solvent Recovery Systems—Oil Conditioners— **AIR APPLIANCE DIVISION,** Multistage Centrifugal Blowers & Exhausters—Industrial Vacuum Cleaning—Portable and Stationary Systems.

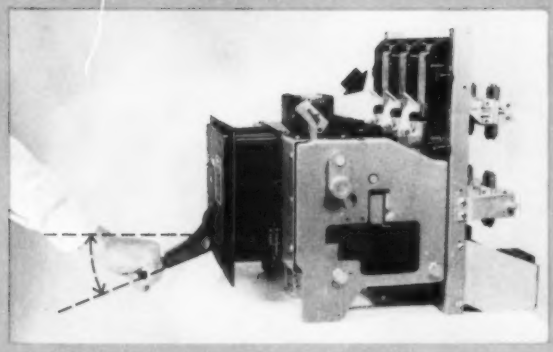
For more facts circle 525 on Reply Card

For more facts circle 526 on Reply Card →

I-T-E new K-Line of low voltage switchgear represents the first major advance in this type of equipment in 13 years. This completely new design offers greatly increased safety and operating efficiency, is available in three frame size ratings: 225, 600 and 1600 amp continuous at 600 v alternating current.







Quick-make closure of contacts on manually operated circuit breakers is provided by spring action. The first 90% of the pulldown handle travel loads the springs, the last 10% releases the stored energy and closes the contacts. No teasing is possible.

I-T-E announces sweeping design advances in new line of low voltage power circuit breakers and switchgear

- First quick-make closure of contacts
- First closed-door racking of circuit breakers to any position
- First expanded range overcurrent trip device
- 4-high stacking of 600 amp frame size circuit breakers
- Subassembly construction of circuit breakers & accessories

Quick-make manual closure eliminates damaging arcing, greatly increases life of contacts and circuit breaker—contacts cannot be teased together, breaker cannot be destroyed by careless closing against a major fault.

Quick-make closure, formerly available only on electrically operated circuit breakers, now is a standard feature of all manually operated breakers in the new I-T-E K-Line.

A manually charged stored energy mechanism, powerful enough to close the contacts safely against a full short circuit, provides the manual quick-make action. The first 90% of travel of the new pulldown handle charges a set of springs, the last 10% of travel releases the stored energy and closes the contacts—breaker life and operator safety do not depend on the brawn and brain of the operator. Contacts cannot be teased together, the closing action is fast and positive.

Electrically operated models in the K-Line have an actuating motor in addition to the basic mechanism. This motor-driven, stored energy system requires only 10 amp from a simple power source, compared to as much as 160 amp by comparable solenoid mechanisms. Energy for closing is prestored by the new K-Line circuit breakers in 2 seconds. Closing time is 5 cycles.

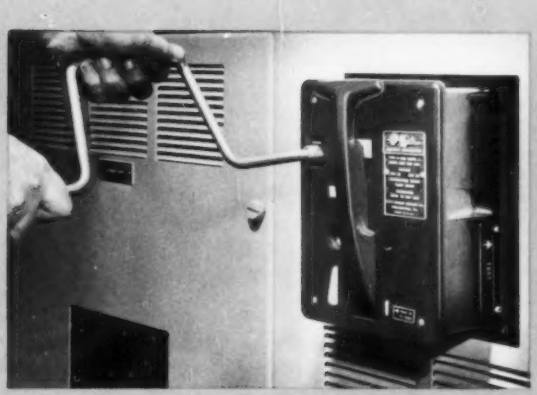
Closed-door drawout keeps circuit breakers clean and aisles uncluttered, promotes operator safety

This exclusive I-T-E feature permits racking of breaker into connected, test and disconnected positions without opening the door of the breaker compartment. It facilitates inspection, testing and maintenance. Blocked circuits are easy to identify. It keeps circuit breakers clean even in dust and dirt-laden atmospheres. It keeps aisles uncluttered and clear of compartment doors. It promotes personnel safety.

A lift shutter, which permits insertion of the racking crank that moves the breaker, can be padlocked in connected, test or disconnected position to guarantee complete safety. This shutter cannot be lifted while the circuit breaker is closed. Interlocking also prevents closing of the breaker while the shutter is lifted.

The extendible escutcheon slides through the compartment door while a dust seal surrounding the escutcheon is held in place by the door.

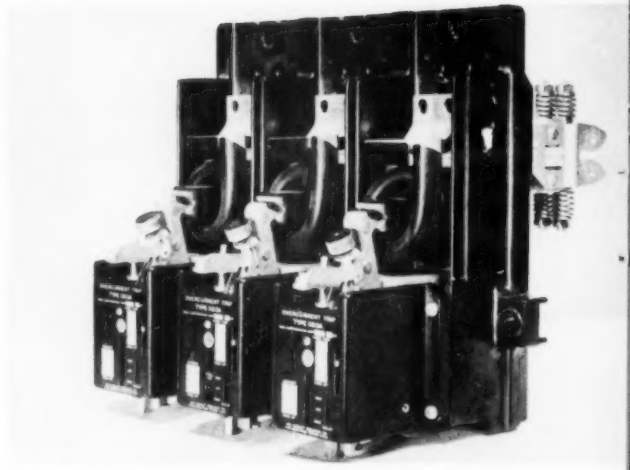
In addition to affording closed-door drawout, the new K-Line of switchgear is smaller than any comparable design. The reduced size of the circuit breakers permits 4-high stacking of 600 amp breakers. And unitized construction reduces the switchgear to three basic components —the breaker, the enclosure, and a cradle on which the circuit breaker rolls for drawout.



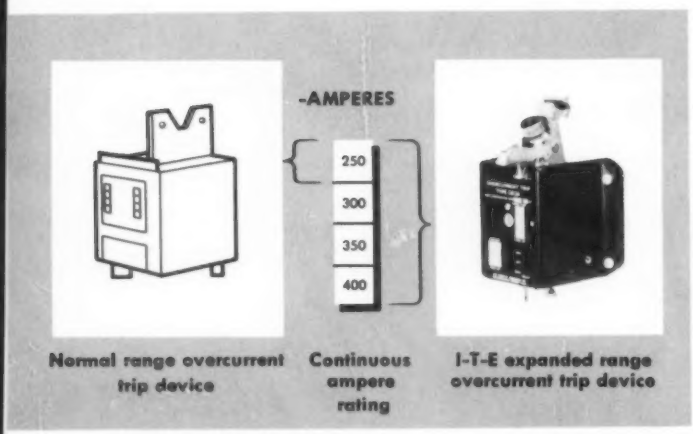
Exclusive closed-door drawout is illustrated in this series of photographs. Photo 1 shows shutter lifted and racking crank inserted. Photo 2 shows circuit breaker in connected position. Photo 3 shows breaker in test position. Photo 4 shows breaker in disconnected position.

New overcurrent trip arrangement permits use of each trip over wider range of continuous load conditions

Accessible trips, on both manual and electrical types, provide new ease of adjustment. Adjustment, a difficult job at best on previous electrical types, can now be made in a matter of seconds.



Common molding holds all three trips for this 600 amp K-Line circuit breaker. Can be replaced in a fraction of time required for changing the individual trips on comparable lines.



This table indicates a sample grouping of ratings for the new K-Line circuit breakers. Only 9 trip units now cover the range of continuous current ratings as against 23 formerly required.

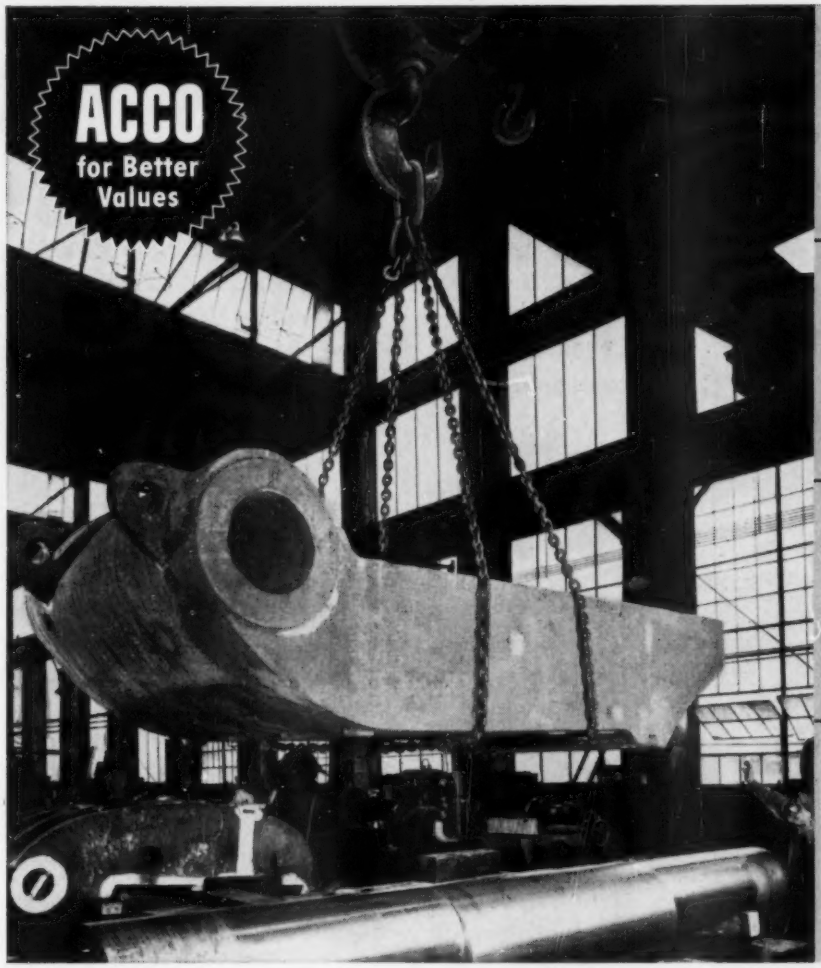
Trip flexibility is an important feature of the K-Line. Only 9 trip units now cover the complete range of continuous current ratings—15 to 1600 amp—as against 23 formerly required. Last-minute changes in load capacity can be satisfied in many instances with the existing trip unit as a result of the expanded range of trip settings.

This feature, plus easy adjustment of trip devices and quick change in the field, is particularly significant in meeting constantly expanding load requirements. Trip units are mounted on a one-piece base. Trip units are changed from the rear and in a fraction of the time formerly required.

For the complete story of the I-T-E K-Line of circuit breakers and switchgear, see your local I-T-E representative. Or write us for Bulletin 6004C. I-T-E CIRCUIT BREAKER COMPANY, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

19TH AND HAMILTON STREETS, PHILADELPHIA 30, PENNSYLVANIA



Accoloy X-weld 125 Chain
Pat. No. 2763768

New Shaped Master Link

ACCO Registration Ring

Registration Certificate

Big, costly loads are safe with Acco Registered® Sling Chains

• Pictured above is a huge, 35,000-pound casting being lifted *easily and safely* by a 4-leg ACCO *Registered* Sling Chain. Directly beneath the load is a highly polished and machined crank shaft worth many thousands of dollars.

Imagine the cost in lost labor and materials, should the sling chain fail! But it won't fail—for this ACCO *Registered* Sling Chain and all its components have the inbuilt strength needed to handle the job with complete safety!

When you buy an ACCO *Registered* Sling Chain, you get these four exclusive "plus values" which *add materially to the worth, but not to the cost,* of the sling:

1 • **Accoloy X-weld 125 Chain**, for extra strength. This chain hangs straight . . . does not kink . . . has extra resistance to bending.

2 • **New Shaped Master Link**, uniquely shaped to withstand deformation under loads up to 18% greater than a round-section link can do.

3 • **ACCO Registration Ring**, serially numbered as evidence that the assembled sling has been factory proof-tested to twice its working load limit.

4 • **Registration Certificate**, signed by us, attesting to the field-tested design and proof-testing of the complete sling.

Remember, the best sling is one of your most economical material-handling tools. You'll find it good business to consult your ACCO *Registered* Sling Chain Distributor on all your sling needs; his counsel is available without obligation. If you don't know his name, write us at York, Pa.

WHAT "ACCO REGISTERED" MEANS

1. The best material
2. Unit safety factor (on bodies, rings, links, hooks)
3. Proof test of complete sling to twice the working load limit
4. Actual field service test of each design
5. Metal identification ring on each sling
6. Signed Registry Certificate with each sling

American Chain Division

AMERICAN CHAIN & CABLE

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TRADE MARK

***Indicates Warehouse Stocks**

For more facts circle 527 on Reply Card

For more facts circle 528 on Reply Card →

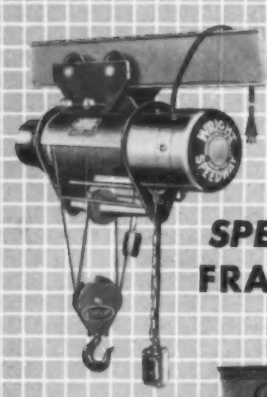
WRIGHT Electric Hoists

NEW ELECTRIC CHAIN HOIST

The new WRIGHT Electric Chain Hoist is available in two size capacities: 300 to 2000 lbs. (single chain) and 3000 to 4000 lbs. (double chain). It is safe, easy to operate, rugged and durable. It is exceptionally valuable for use on production lines, over machine tools or any shop location where space is at a premium.

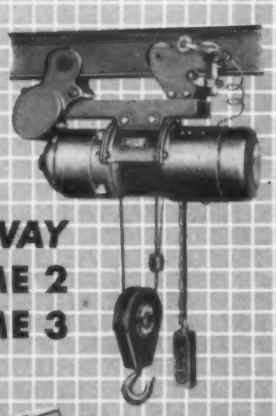
2-SPEED *SPEEDWAY* FRAME 1

WRIGHT now offers a *Speedway* Two-Speed Hoist in the Frame 1 size. It permits precise, gentle positioning of production work in capacities from ¼ ton to 1 ton. This hoist gives a fast lifting and lowering speed —and a slow speed (¼ the rate of the fast speed) by the use of 1800/450 RPM motors.



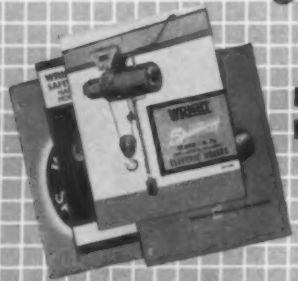
SPEEDWAY FRAME 1½

WRIGHT *Speedway* Electric Hoists are built to meet the many and varied demands of modern high-speed production. Many design improvements minimize maintenance costs and down-time. The Frame 1½ Hoist will handle loads of from 1½ to 2 tons. The Type L-1½ shown is 4-part reeved and intended for relatively slow lifting speeds.



SPEEDWAY FRAME 2 FRAME 3

WRIGHT Frame 2 *Speedway* Electric Hoists are capable of handling loads from 1½ to 6 tons. The Frame 3—from 1½ to 10 tons. WRIGHT *Speedway* Hoists are available with single or variable speeds and with a wide variety of mounting arrangements to meet specific requirements.



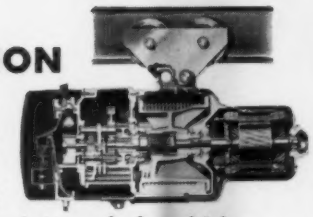
FOR COMPLETE INFORMATION

Ask for the following booklets for complete information on WRIGHT Hoists and Crane components: Speedway Hoists (Frame 1-1½) Booklet DH-133B, (Frame 2 and 3) Catalog E-55B • Motor Driven Cranes—Underhung, Single Bridge—Bulletin #227; Top Running Cranes—Bulletin DH-448 or DH-449 • Crane Drive Units—Booklet DH-431A • Hand Traveling Cranes—Bulletins DH-468 and DH-348B.

for Lowest Final Cost

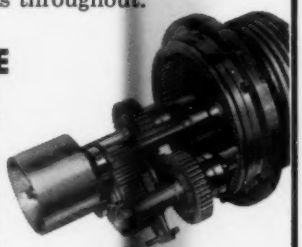
These features make WRIGHT Speedway Hoists your best buy for—

MORE PRODUCTION



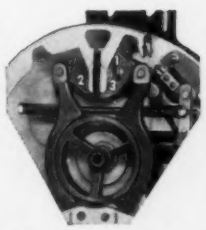
Fine balance and heavy duty design make possible the continuous handling of tough jobs on any duty cycle for which a 30-minute NEMA motor is satisfactory. All gears and pinions are alloy steel, heat-treated. Their ductile core supplies shock resistance to most severe service stresses. Anti-friction bearings throughout.

LONGER LIFE



Strength of gear teeth of WRIGHT Frame 2 and 3 Speedway hoists has been doubled by a change in contour and grain structure of the metal. Internal gear ring with heavy flanged cross section is bolted to drum at six points and provides extreme resistance to distortion.

EASIER MAINTENANCE



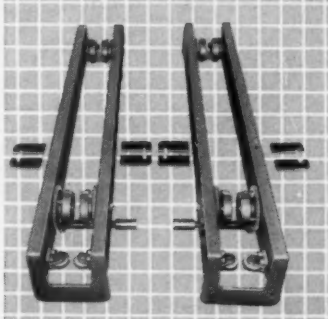
There is nothing to adjust but the cam to keep brake in perfect adjustment. When excessive load drift occurs... remove the screw shown at Position 1, swing the cam until Position 2 is in line. Replace the screw. Position 3 is provided for the final third of brake lining wear. Brake springs and solenoid never need adjustment.

Better performance at lower cost by using WRIGHT units for local-built cranes

SPEEDWAY ELECTRIC HOIST

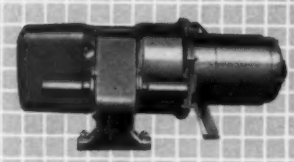
Available in Frame 1, 1½, 2 and 3 sizes with capacities from ¼ ton to 10 tons.

END TRUCKS



For motor-driven cranes and hand traveling cranes—both top running and under-hung types. Timken bearings throughout. Wide range of capacities.

CRANE DRIVE UNIT



For crane and double-beam trolley propulsion. Electric motor transmits power through fluid drive to well proportioned gear reduction. Units are equipped with WRIGHT designed solenoid "drag" brake. Size 1—with motors to 2 HP. Size 2—with 3 to 7½ HP motors.

Wright Hoist Division
AMERICAN CHAIN & CABLE

York, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

ACCO

PLANT ENGINEERS' DIGEST —so those who rush may read and know what's new

Edited by Marjorie E. Weissman

Conveyor Tube Glass-Insulated

BECAUSE OF EXTREME WEATHER conditions (temperatures have reached as low as —50F in winter) Steep Rock Iron Mines Ltd. have made plans for both surface and sub-surface mining at their Atikokan, Ontario mine.

During the winter, a conveyor belt carries the ore from far below the surface to a "tipple" above ground. From the point where it emerges from the ground to the "tipple," the belt is enclosed in an 8-ft diameter steel tube.

Due to the wet condition of the ore and the severe outside temperatures, moisture condensed on the cold surface of the tube, building up heavy frost layers more than six inches thick, which interfered with the operation of the conveyor.

At the outset, the tube was heated from within by a steam pipe and covered with an insulation. This in turn had a weatherproof coating. However, the combination of severe moisture problem within the tube and extreme outside weather conditions, caused this particular type insulation to fail.

Cellular glass insulation is applied to conveyor tube used for moving iron ore

The tube was reinsulated, this time on the inside, using a cellular glass insulation.

A 60-ft long tube was first insulated and placed in use during the winter of 1954-55. It proved so successful that a second 260-ft long tube has now been insulated and placed in service.

To insulate the top half of the tube, pins were stud welded to the inner surface which was then primed with an asphalt primer. A layer of 1½ in. thick Foamglas was next applied with hot asphalt. Insulating blocks were also impaled on the pins and secured with spring clips. Another layer of 1½ in. insulation was then applied using hot asphalt as the adhesive. A final finish of mastic was then troweled on. On the bottom of the tube, the cellular glass insulation was mopped on with hot asphalt and concrete poured directly over it. *From a release of Pittsburgh Corning Corporation, Pittsburgh, Pa.*

Safety First With Electric Switches

Operating power switch with left hand may prevent burns, fractures. (From The Mandonian, published by Minnesota & Ontario Paper Co., Minneapolis, Minn.)

Easy-Do Line Connections

A MODIFIED 19-ft-bed lathe, developed by Keasby & Mattison Co., Ambler, Pa. and used in its St. Louis, Mo. plant for final machining of asbestos-cement pipe, is operated by hydraulic and pneumatic pressure.

Quick-connect couplings are used to connect hydraulic and pneumatic lines so that when it is necessary to repair or clean these lines, or to make adjustments, the couplings can be disconnected in a few seconds and the fluid or air sealed off immediately. No special tools or extra personnel are needed for this job. Couplings can be reconnected in a few seconds to resume lathing.

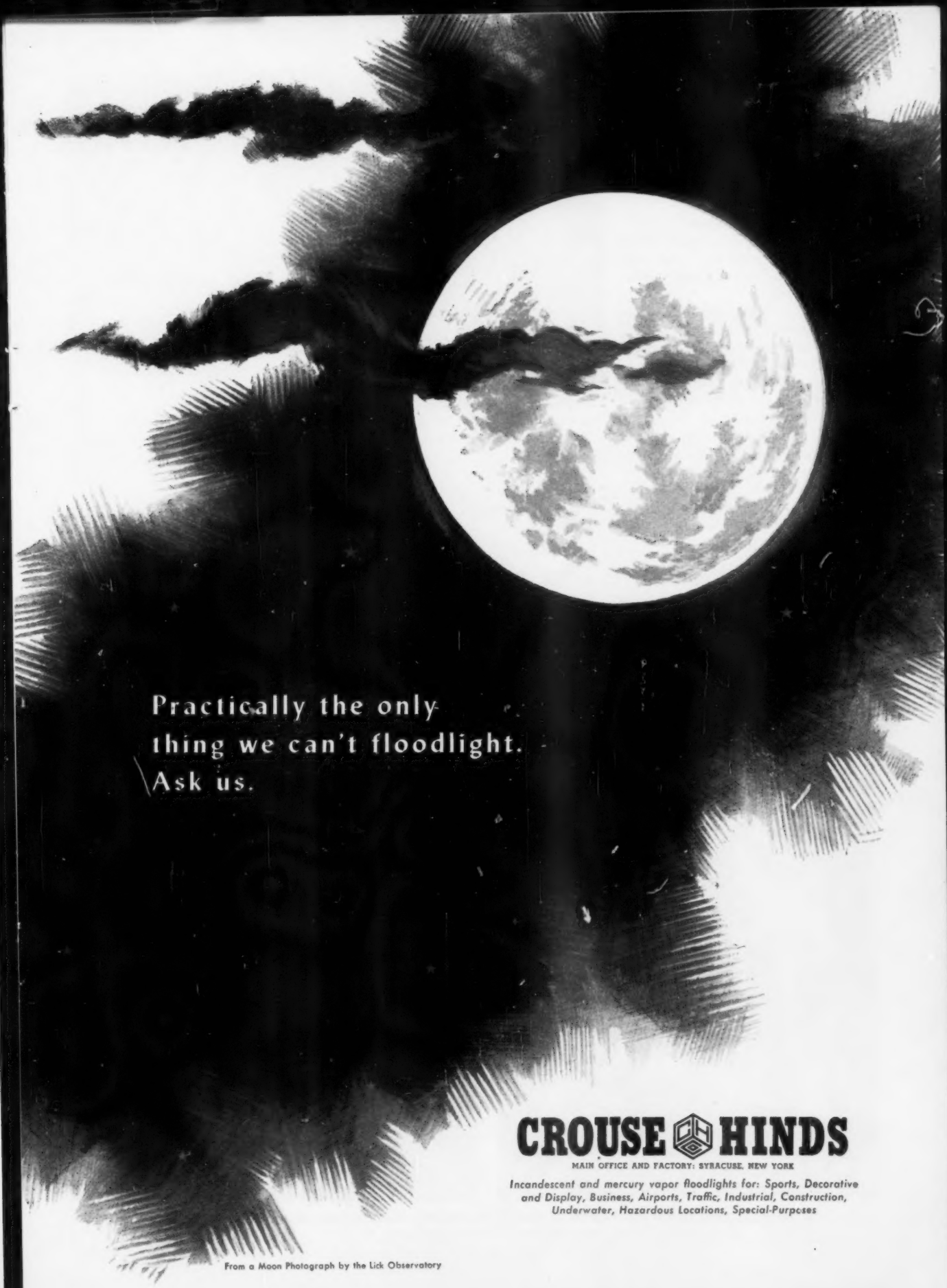
A total of 20 couplings, which take up to 400 psi hydraulic pressure and 100 psi pneumatic pressure for the lathing operation, are used. *From a release of Titeflex, Inc., Springfield, Mass.*

Safety Controls for Fumes

AUTOMATIC, self-powered safety controls have helped a manufacturer of laboratory equipment provide needed protection against dangerous chemical fumes.

At the plant, metal laboratory parts are thoroughly cleaned in several three-by-five foot vapor degreasing tanks prior to plating. Trichloroethylene vapors are used to remove dirt, dust, grime and grease.

The top of the degreasing tank is surrounded with coils containing cooling water used to condense these



From a Moon Photograph by the Lick Observatory

CROUSE HINDS

MAIN OFFICE AND FACTORY: SYRACUSE, NEW YORK

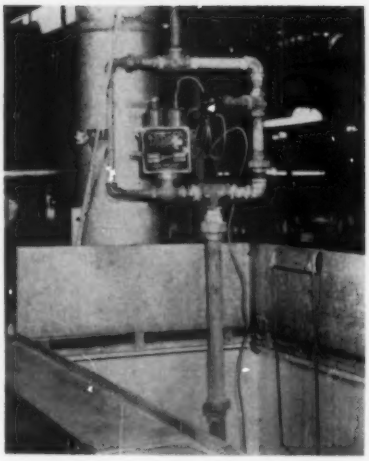
Incandescent and mercury vapor floodlights for: Sports, Decorative and Display, Business, Airports, Traffic, Industrial, Construction, Underwater, Hazardous Locations, Special-Purposes

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

vapors which are considered hazardous. Any malfunction of either heating or cooling coils can cause the vapors to overflow, although they are heavier than air.

To control this situation, the safety control device was installed. Here is how it works. The steam to the heating coil of the cleaning solution is fed through a valve which is triggered by the safety mechanism. The pressure element of the safety device is connected to the cooling water supply line. A thermal bulb is installed above the condensing coils. On failure of cooling water supply, the safety control will trip, closing the steam heating supply.



Safety control unit installed on vapor degreasing tank provides triple protection against trichloroethylene vapors

The second safety feature of the control trips the instrument in case the dangerous vapors rise above the condensing coils for any reason. Finally, if the sealed thermal system of the safety control is damaged or otherwise loses its charge, the degreasing unit will shut itself off automatically. *From a release of Fulton Sylphon Division, Robertshaw-Fulton Controls Company, Knoxville, Tennessee.*

Heating Make-Up Air

FINAL STAGES in the production of hermetically sealed electric motors require completely dust-free room air. In one company, a large quantity of make-up air which had to be heated, was required to keep the building under slight positive pressure in order to prevent the infiltration of dust into this operation.

By installing direct gas-fired line burners in the fresh air inlets, 100 per cent heating efficiency of the make-up air was obtained.

The line burner equipment was

(Continued on page 44)

Plastic Pipe Fitting Fixtures Are Easy To Use, Move or Store

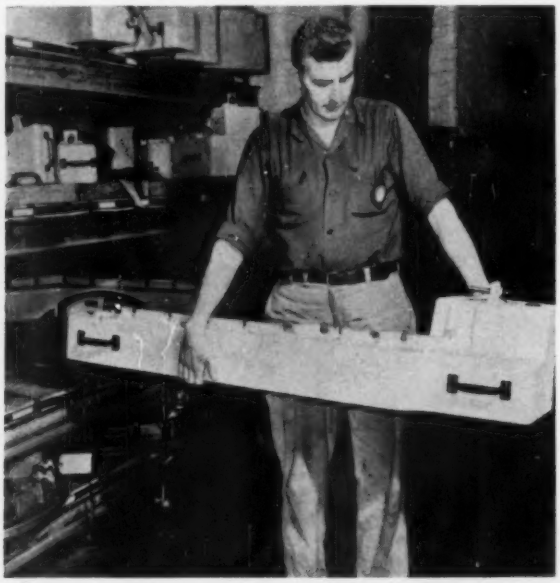
PIPE CHECKING fixtures made with epoxy resins are used by Pratt & Whitney Aircraft, Division of United Aircraft Corporation, East Hartford, Conn., to increase production and effect substantial savings.

By using these compounds, supplied by Ren Plastics, Inc., tooling time for the fixtures is reduced by about 76 per cent and labor costs are lowered by about 18 per cent. In addition, the fixtures are about 70 per cent lighter than previous units, and are much easier to use, move or store.

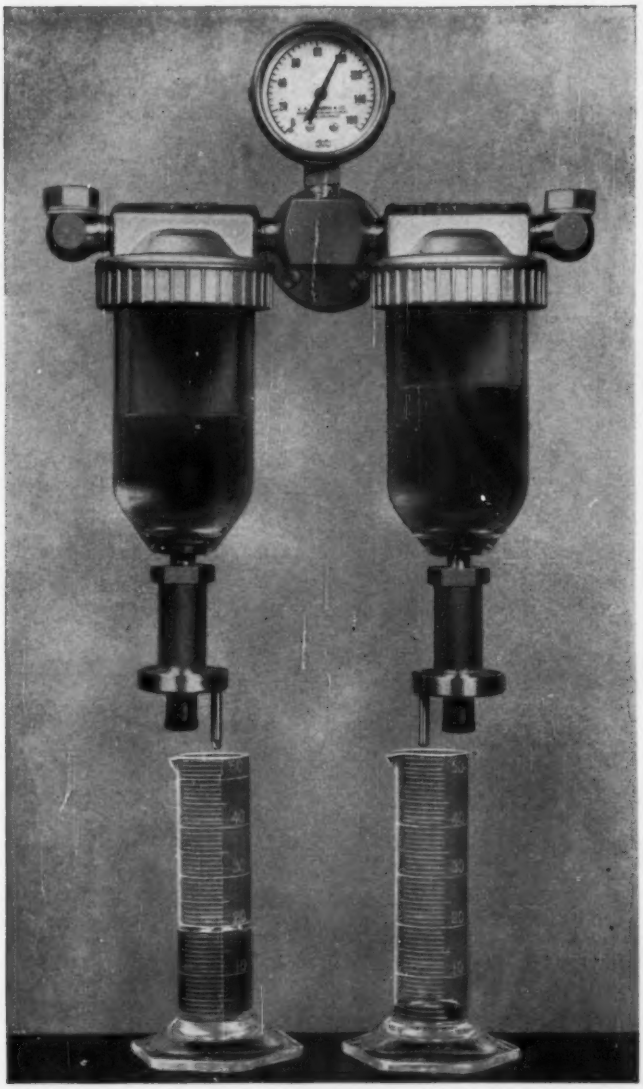
Because of the many and frequent tubing design changes for jet engines, reduction in the fabrication time and checking of fixtures has increased production. The plastic fixtures are used by the company's engineering department and also the pipe supplier to make certain that the changes are accurately made.

Using conventional methods, it often took weeks to make new tools for new designs, but with epoxies the new tools can be ready in a few days. *From a release of the Bakelite Company, Division of Union Carbide Corporation, New York, N. Y.*

Before: Two men, lift truck, move and store metal fixtures



After: Fixture, made with epoxy resins, is lifted by one man



ANTILEAK DEMONSTRATION

Suntac oil in one chamber, your present hydraulic oil of the same viscosity in the other. Both oils are forced out through sintered bronze bearings. In this photograph, pressure of 100 psi caused a straight mineral oil to leak out four times faster than Suntac.

SUNTAC CUTS HYDRAULIC OIL LOSS AS MUCH AS 75%

See this demonstration in your plant

Take about five minutes at your own desk to learn how Suntac® oils stay put in hydraulic systems . . . reduce oil loss through loose joints and worn fittings.

Match Suntac against the hydraulic oil you're now using—see how the exceptional non-gummy antileak characteristics of Suntac can reduce your oil losses as much as 75%. *Some users have even reported savings of 90%.*

Call Your Sun Representative

Have him arrange with a Sun Lubrication Engineer to give you and your staff a private demonstration. For further information on the uses of Suntac in hydraulic systems and in general lubrication, write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. Py-1

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INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

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"Buffalo"
Breezo-Fin Unit Heater

LEAK-PROOF MEANS SAFE FOR HIGH-PRESSURE STEAM JOBS!

Nothing can match the "Buffalo" Breezo-Fin Unit Heater for versatile, economical, efficient "spot-heating" in your plant. Breezo-Fins are especially desirable for your high pressure steam system because **there is no possibility of leakage inside the unit.** The one-piece, seamless copper coil is continuous from inlet to outlet discharge ground joint. This positive "no-leak" feature insures absolute safety for steam pressures up to 250 lbs.

OTHER "BUFFALO" BREEZO-FIN FEATURES:

- **Fins spaced for maximum radiation.**
- **Adjustable louvers to aim heat where needed**
- **Streamlined, attractive appearance.**
- **High-efficiency fans give quiet operation.**
- **One-piece welded motor mounting.**
- **Rugged construction for trouble-free life.**
- **Side connections for low headroom, more compact installation.**

For full information on "Buffalo" Breezo-Fin Unit Heaters, write today for Bulletin 3137-E.

FOR HEATING LARGER PLANT AREAS . . .

investigate "Buffalo" Lowboy and Highboy Unit Heaters. Ceiling-suspended Lowboys save valuable floor space. Compact Highboys allow more productive space in low-ceiling areas. Write for Bulletin 3704 for full details.

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INDUSTRIAL EXHAUSTERS BELTED VENT SETS PROPELLER FANS "E" BLOWERS-EXHAUSTERS

For more facts circle 531 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

Outlet vents are evenly spaced over assembly line, providing warm make-up

installed in the inlet ducts with the burner ports facing in the same direction and parallel to the flow of outside air from the blowers. In this way, the burner flame along the entire slot length withstands air velocities of up to 2500 fpm without blowing off.

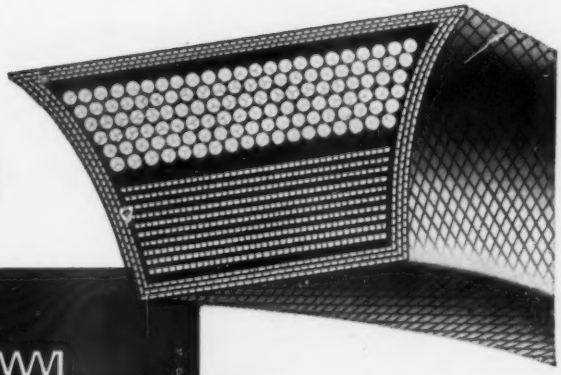
The distribution plenum consists of a straight run along one end of the main motor assembly table. Six outlets are so placed to provide an even flow of air at 73 F down toward the workers. The heated air then moves across the room along the floor and is exhausted. *From Heat Treat Review, published by Surface Combustion Corp., Toledo, Ohio.*

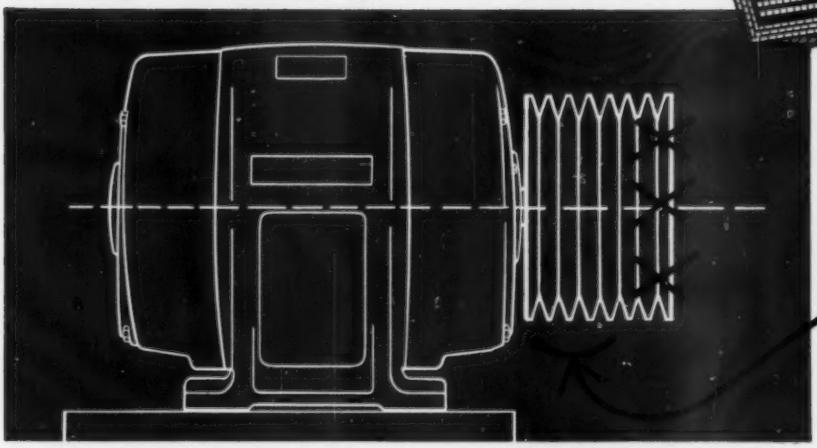
It's Done With Mirrors

MACHINE OPERATION for wrapping and packing tablets in a tape strip pack at the plant of Aspro-Nicholas Ltd., England, formerly required two workers to operate each machine.

By providing adjustable, standard design driving mirrors, it was possible to operate the machine with one worker. The mirror enables the operator at the delivery end of the machine to watch the feed mechanism, normally hidden from her view. This job was formerly han-

Get the same HP with fewer belts





5 Gates Super Vulco Ropes do the work of 7 standard V-belts

Cut sheave width and weight ... save in overall costs of your drive by using Gates *Super* Vulco Ropes with 40% more hp capacity.

5 Gates Super Vulco Ropes will do the work of 7 Standard V-belts. A Super Vulco Rope Drive delivers more HP per dollar invested than any standard V-belt drive.

Sheaves with fewer grooves cost less ... weigh less ... occupy less space. Your drive design is improved.

Helpful drive data is quickly available to you. Simply call your nearby Gates distributor for advice from a Gates V-belt specialist. Stocks carried in industrial centers throughout the world.

No other V-Belt has ALL these advantages

1. Flex-Weave Cover (U.S. Pat. 2519590)
A Gates exclusive: provides greater flexibility with far less stress on fabric. Cover wears longer ... increases belt life ... more power available to driven machine.

2. Concave Sidewalls (U.S. Pat. 1813698)
Concave sides (Fig. 1) increase belt life. As belt bends, concave sidewalls become straight, making uniform contact with sheave groove (Fig. 1-A). Uniform contact means less wear on sides of belt ... far longer belt life.

3. Tough, resilient Tensile Cords
Super strong resilient tensile cords provide 40% greater horsepower capacity ... easily absorb heavy shock loads ... reduce number of belts required, save weight and space.

4. High Electrical Conductivity
Built into Gates Super Vulco Ropes for safer drives (in explosive atmosphere).

5. Oil Heat, Weather Resistant
Special rubber compounds make Super Vulco Ropes highly resistant to heat, oil, and prolonged exposure to weather.

The Gates Rubber Company Denver, Colorado

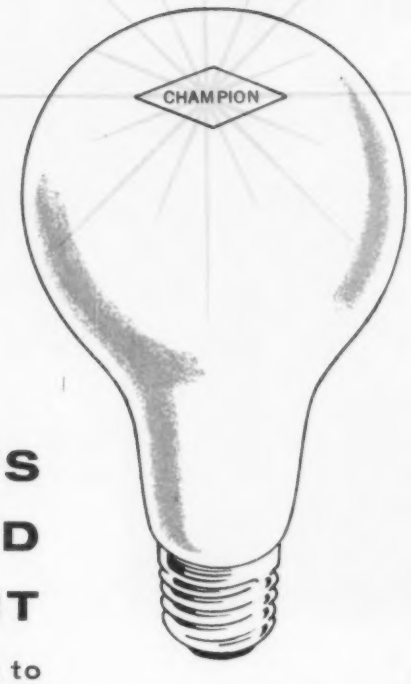
Gates Distributors are in the Yellow Pages

The Mark of *Specialized* Research

TPA 277

Gates Super V VULCO ROPE Drives

For more facts circle 532 on Reply Card



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LIGHT
thanks to
CHAMPION LIGHTMANSHIP

Strict Quality Control—
One example of how Champion applies Lightmanship to make sure you get all the light you pay for. Photometric testing, as shown at the left, helps in maintaining the light output of Champion Lamps at the highest possible level.

MILLIONS OF LAMPS A YEAR . . .
ONE PLANT standard of quality control

CHAMPION Lamps
Incandescent Fluorescent
Your best buy in lamps
CHAMPION LAMP WORKS
Lynn, Massachusetts
A division of Consolidated Electric Lamp Co.

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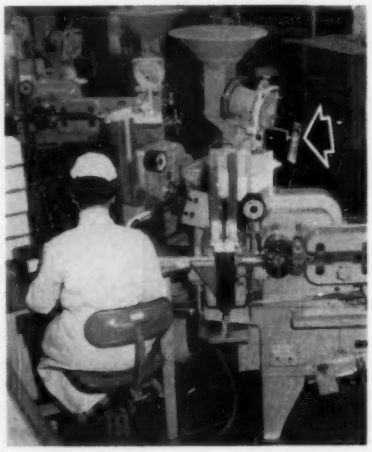
PLANT ENGINEERS' DIGEST

(Digest begins on page 40)



Mirror, arrow, permits the operator at delivery end to watch feeding mechanism, previously hidden from view

dled by the second worker to see that the throat through which the tablets were ejected one at a time onto a moving band of paper did not become blocked.

Later modifications to the mechanical process, including the installation of a trip gear for automatic stoppage in the event of a misfeed or other snag, made it possible for one girl to feed two machines. *From Target, published by Central Office of Information, London, England.*

Plastic Pistons

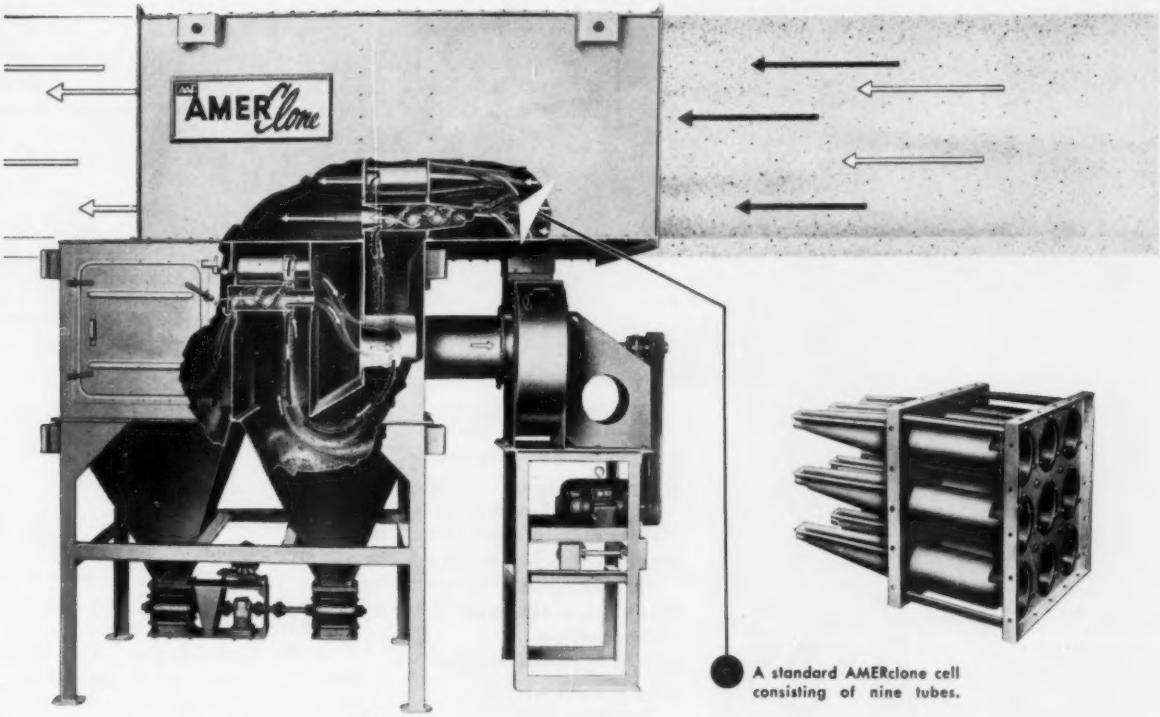
BY USING PISTONS made of acrylic plastic instead of metal in filling machinery, the Hope Machine Co. of Philadelphia avoids damage to the cylinders in case of breakage of the O ring.

Even if forced against the cylinder wall, the plastic pistons, machined from sheet stock, do not mar the surface and only replacement of the O ring is necessary. *From a release of Rohm & Haas Company, Philadelphia, Pa.*

Camera Photographs Blast Furnace Temperatures

BLAST FURNACES, open hearths, coke ovens and other steelmaking facilities appear in all the colors of

NOW! Positive Control of FLY ASH



A standard AMERclone cell consisting of nine tubes.

AAF AMERclone . . . WORLD'S NEWEST DRY CENTRIFUGAL— MAINTAINS EFFICIENCY REGARDLESS OF BOILER LOAD.

THE AAF AMERclone was designed and built with one big dust control problem in mind—the effective and economical control of boiler fly ash. AMERclone puts this menace where it belongs—in the ash disposal system where it can do no harm.

This rugged dry centrifugal AMERclone operates with constant particle-size efficiency *at all times*, regardless of steam load fluctuations. What's more, AMERclone requires less space than other centrifugals because each 20" x 20" cell has a rating of 3,000 cfm! Wear is greatly reduced because AMERclone design eliminates re-entrainment of fly ash within the unit.

Get all the facts on AMERclone. Call your local American Air Filter representative or write direct for Bulletin 291.

AAF Herman Nelson

American Air Filter
COMPANY, INC.

228 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal 9, P. Q.

Air Filters and Precipitators

Illinois Heating Specialties

BETTER AIR IS OUR BUSINESS

Herman Nelson Unit Heaters

Herman Nelson Portable Heaters

For more facts circle 534 on Reply Card

CM Lodestar®

FEATURING:

- Push Button Control
- Ultra-Modern Regenerative Electric Braking
- Self-Adjusting Heavy Duty Magnetic Brake
- Sealed-in Lifetime Lubrication
- Overload Protection
- Fully Enclosed Components
- Lowest Headroom
- "CM-Alloy" Flexible Link Chain

CAPACITIES: from ⅛ to 1 ton. Single and 3 phase. ¼ ton model weighs only 51 pounds.

$161.45 and up
F.O.B. Factory

Built to serve you without costly maintenance

Lodestar is the first truly "heavy duty" version of the small electric hoist. The CM Lodestar is designed to operate without costly maintenance or interruptions in your work schedules. The initial cost is practically your only cost with a Lodestar... an extremely low cost indeed!

WRITE US or call your CM distributor for literature, prices and quick delivery from stock.

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CM HOISTS AND CHAIN

For more facts circle 535 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

the rainbow through the lenses of an "evaporograph," a new type of camera now in use for the first time in the steel industry at our Fairless Hills, Bucks County, Pa., works.

Developed by Baird-Atomic, Inc., Cambridge, Mass., as a direct thermal-imaging device, the new instrument functions as efficiently in absolute darkness as in daylight. It forms a colored, two-dimensional image by utilizing the long wavelength, infrared radiation emitted from the object or area being photographed.

Sensitivity of the device is such that differences of as little as 1C can be detected in the target temperatures.

Test observations and color photographs made with the instrument throughout the mill area have shown that temperature differences on the exterior surface of high-temperature operating units make possible the study of interior wall conditions in such installations as open hearths and blast furnaces.

It shows promise also as a detector of hot-spots or worn areas in machinery, steam lines and other auxiliary mill equipment where temperature is a measure of interior conditions.

The heart of the new instrument is the evaporograph cell, a vacuum-enclosed membrane on which a thin film of oil condenses.

The membrane is illuminated with white light. Interference between light reflected from the front and rear surfaces of the membrane has the effect of cancelling certain wavelengths in the incident light and gives the membrane a colored appearance.

The viewing optical system is equipped with a light source which illuminates the membrane uniformly and forms an image of the membrane both on photographic film and in an eyepiece for direct observation.

By employing a reference temperature in the field of view, the evaporograph can be used to calculate unknown temperatures. By comparison of colors on the membrane, differences of temperature in the

The Yarway Impulse started a new era in steam trapping...

. . . it began in 1935, when Yarway applied a unique principle of thermodynamics to steam traps—and the Yarway IMPULSE Steam Trap was born.

Since then over 1,225,000 Yarway IMPULSE traps have proved themselves so well in service that today many other type traps are regarded as obsolete—an understandable reason why the Yarway IMPULSE type of steam trap is being imitated.

To industry, the Yarway IMPULSE trap makes possible a new high in thermal efficiency of equipment, a new low in trap operating maintenance . . . resulting in increased production and higher profits.

THE THERMODYNAMIC PRINCIPLE

This is the principle on which the Yarway IMPULSE trap design is based—that variations in temperature of water discharging through two orifices in series cause variations in pressure in an intermediate chamber between the orifices, and that these changes in pressure may be utilized to open and close the trap valve.

ONE MOVING PART

There is only one moving part in a Yarway IMPULSE trap—a small, stainless steel valve. The entire valve assembly can be replaced in 5 or 6 minutes. It is the simplest of all steam traps to service.

EQUIPMENT HOTTER, SOONER—STAYS HOT

At "start up" the little valve opens wide to discharge air and condensate continuously. This brings equipment into production in the quickest possible time. The valve then actually floats on the condensate load, maintaining highest, steady temperatures.

A YARWAY IMPULSE STEAM TRAP TO MEET EACH TRAPPING REQUIREMENT

Research and development in the Yarway Steam Laboratory, plus intensive field testing, have produced a line of steam traps—*all* of the Yarway IMPULSE type . . to efficiently meet each of the following classes of trapping service:

Normal requirements for pressures up to 600 psi call for Yarway Series 60 and 120 IMPULSE Traps in six sizes, ½" to 2".

Light loads for pressures up to 600 psi call for the ½" Yarway No. 20-A and No. 120-A IMPULSE Traps.

Heavy loads for pressures to 600 psi call for the extra high capacity Series 40 Yarway IMPULSE Trap, available in five sizes, ½" to 2½".

Highest pressure and marine requirements up to 2500 psi are met by the Yarway Integral-Strainer IMPULSE Trap, in six sizes, ½" to 2", flanged, screwed and socket weld types.

PLUS ADVANTAGES

- Small size and light weight
- Easy, low cost installation
- Minimum maintenance
- Non-freezing
- Stainless steel construction
- No adjustment of valve or seat needed for any pressure
- Low initial cost

NATIONALLY STOCKED, SOLD AND SERVICED

Over 270 Industrial Distributors stock and sell Yarway IMPULSE Steam Traps . . . and over 35 Yarway field engineers are available to help you select the right steam trap for the job.

Write for free, new bulletin "*The Why and How of Steam Trapping.*"

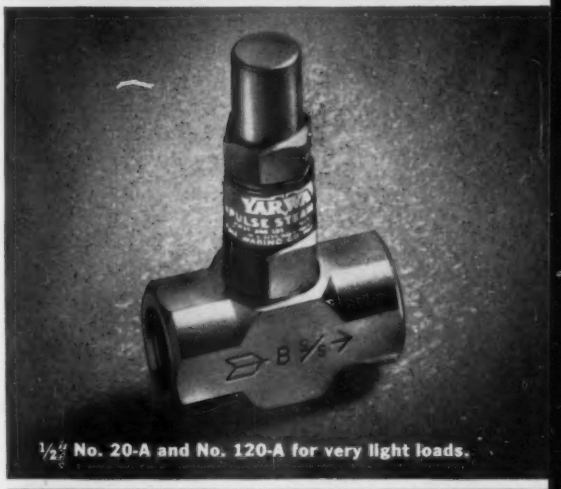
YARNALL-WARING COMPANY
145 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY *impulse*®

...a good way to specify steam traps

For more facts circle 536 on Reply Card

Series 60 and 120 for normal requirements.



½" No. 20-A and No. 120-A for very light loads.

Series 40 for very heavy loads.

Integral Strainer Impulse Traps for highest pressures and marine use.

Weston slices downtime with *Snap-on* mobile tool sets

Here a maintenance man uses a *Snap-on* wrench to reset a punch press. He states, "Man, what a difference. With these roll cabs we always have the right tool at the right place at the right time. It sure cuts the downtime."

"You can cut waste time way down with these tool sets and roll cabs," *Snap-on* Tools sales engineer, Perry Rose, told plant officials at Weston Electrical Instrument Corporation, a subsidiary of Daystrom, Inc., Newark, N.J.

Previously, the company's maintenance men reset and maintained punch presses with a limited number of tools located at a fixed spot in the plant. Today six custom *Snap-on* tool sets on wheels, one for each maintenance team, are conveniently located around the department.

Rose worked closely with Weston maintenance people to provide exactly the right tools for the work. The result: a big reduction in downtime — big increase in profitable production time.

Here is another typical case where a trained *Snap-on* sales engineer spotted a situation and recommended a time- and money-saving idea. The *Snap-on* man makes it a regular part of his job to analyze production or maintenance problems — then recommend the proper hand tools. He also develops original equipment tool kits, as well as sets for field service work. *Snap-on* branch offices are located in over 54 key industrial centers throughout the U.S. and Canada.

SNAP-ON TOOLS CORPORATION
8068-A 28th Avenue • Kenosha, Wisconsin

For more facts circle 537 on Reply Card

PLANT ENGINEERS' DIGEST

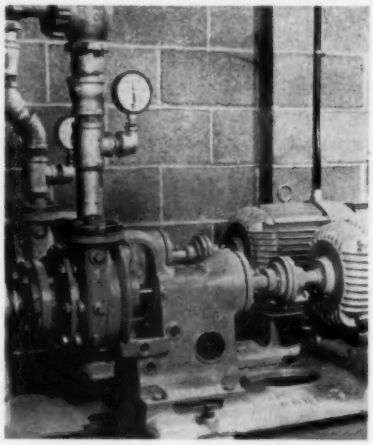
(Digest begins on page 40)

area being inspected are readily seen.

Thus, the new device serves the dual purpose of making temperature differences visible and permitting temperature measurements to be made from images produced. *From a release of United States Steel Corp., Chicago, Ill.*

Water Costs Cut

LARGE QUANTITIES OF WATER are required for cooling the air compressors and the arc and induction melting furnaces at plant of Empire Steel Castings, Inc., Reading, Pa.



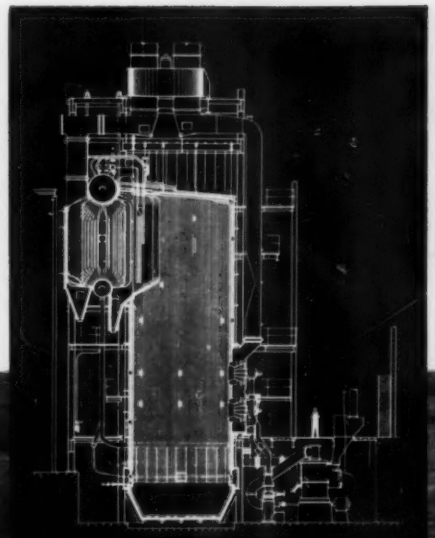
Two of the pumps which handle all recirculated water for three compressors

This water was formerly purchased and discharged to waste as used. One compressor alone used water at the rate of 30 gpm, the monthly water bill for it amounting to $120.00.

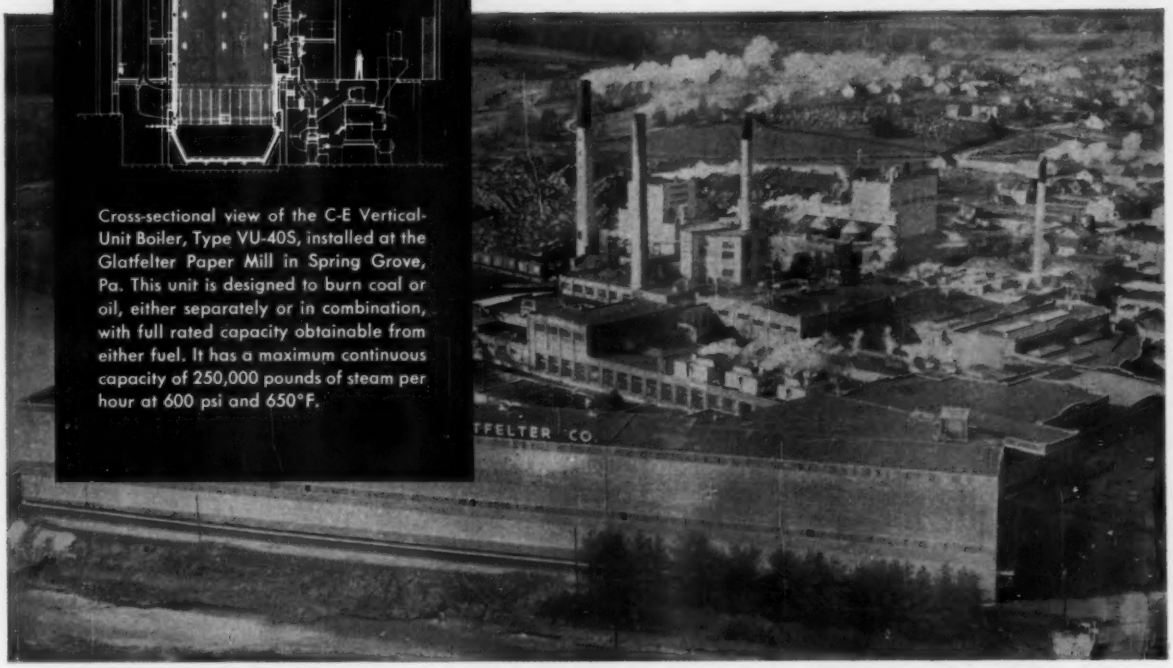
A recirculating system was installed, consisting of a cooling tower, circulating pump and a softener at a cost of approximately $1000.00. The savings in water costs on this trial installation paid for the equipment in 18 months.

Subsequently the system was enlarged, reducing the average monthly water bill from $740.00 to $120.00. The enlarged system includes seven circulating pumps all of the support head end suction type. *From Goulds News, published by Goulds Pumps, Inc., Seneca Falls, N. Y.*

C-E BOILER "Makes a hit" AT NEW GLATFELTER PLANT



Cross-sectional view of the C-E Vertical-Unit Boiler, Type VU-40S, installed at the Glatfelter Paper Mill in Spring Grove, Pa. This unit is designed to burn coal or oil, either separately or in combination, with full rated capacity obtainable from either fuel. It has a maximum continuous capacity of 250,000 pounds of steam per hour at 600 psi and 650°F.



The recent start-up of this new paper mill marked the completion of the P. H. Glatfelter Company's largest expansion in its 93-year history. Included in this expansion was a new Fourdrinier paper machine, a 177-acre lake, and a C-E Vertical Unit Boiler. This new mill, which is in the best tradition of modern industrial architecture, has a potential capacity of over 300-tons daily.

Consulting Engineer tells why . . .

After completion of Acceptance and Peak Load Tests on a C-E Vertical-Unit Boiler, Type VU-40, at the P. H. Glatfelter Company's new Spring Grove, Pennsylvania, paper mill, The H. M. Wilson Company, Consulting Engineers of Philadelphia, commented as follows:

"Now, having determined the results of the tests, we are happy to advise you that the overall performance of the boiler was excellent, and we feel that this particular boiler is of outstanding design and construction. We have previously commented on the excellent cooperation of your Engineering Department in the design and development of this boiler, and can only reach the conclusion that your entire organization has been most cooperative and has done a fine job."

This opinion finds added significance in a statement by the company president, Mr. P. H. Glatfelter, III, who states, "We are well pleased with our choice of this C-E boiler for our new plant."

We, of course, are proud of this boiler, which, like the many other C-E installations of this and other types, is proving its superiority under actual operating conditions. When *you* need boilers, remember that Combustion Engineering has a complete line of steam generating and fuel burning equipment—a size and type that will meet your requirements exactly.

COMBUSTION ENGINEERING

C-E

C-136A

Combustion Engineering Building

200 Madison Avenue, New York 16, N. Y.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

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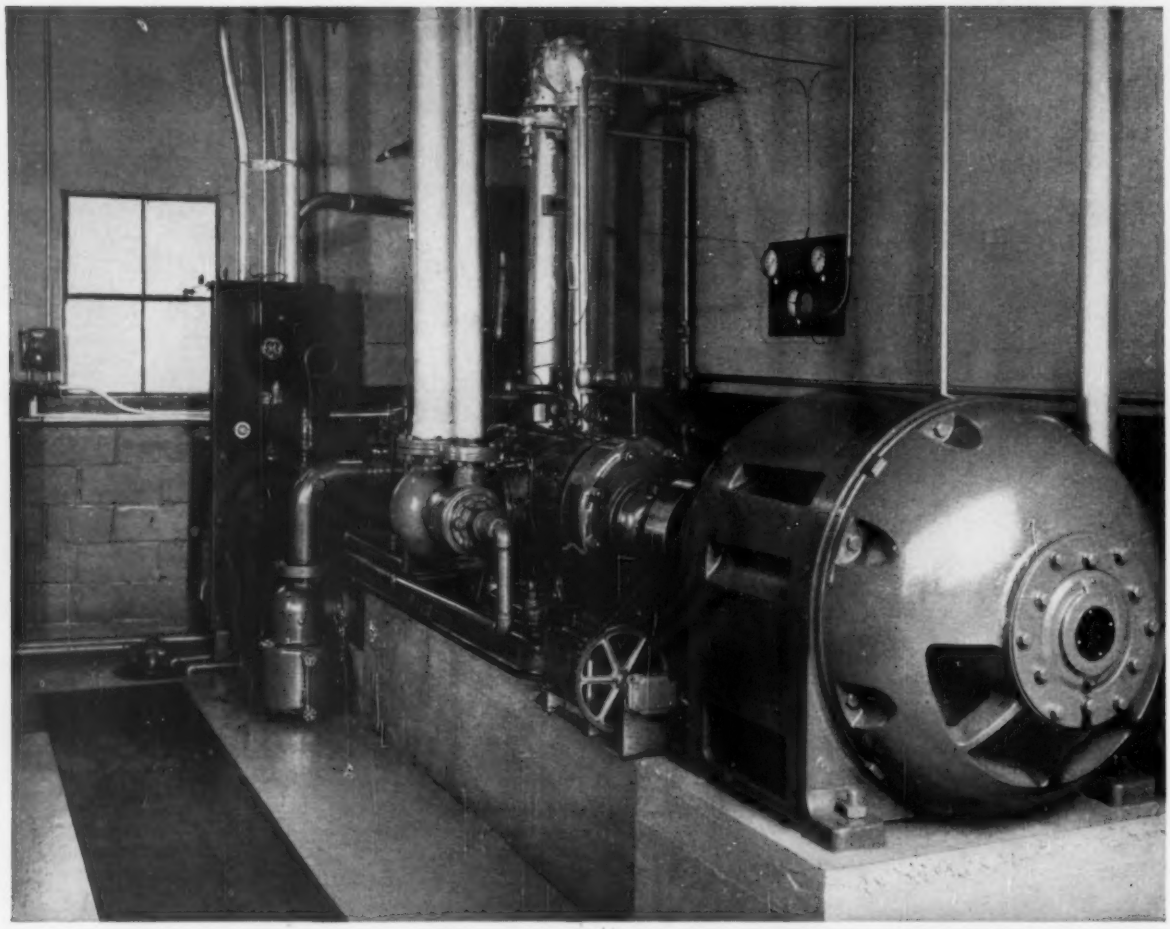

Fuller Rotary Two-Stage Compressor, C135-135H. Capacity 680 c.f.m., 100-lb. pressure, 690 r.p.m., 150 hp. motor.

16,000 HOURS OF OPERATION WITH NO MAINTENANCE

Empire Steel Castings, Inc., Reading, Pennsylvania, installed a C-135-135H Fuller Rotary Two-stage Compressor in April 1953. After 32 months—approximately 16,000 hours of operation—the compressor received a routine inspection, when a new set of blades was installed in the higher-pressure cylinder.

The Empire engineers report no downtime since replacement, although they've added 4,000 operating hours. Prior to switching to Fuller, their former experience with compressors was a different story—as many as several overhaulings in one year. With Fuller equipment furnishing a constant high capacity air supply, production costs have been greatly reduced.

Here's how Empire uses compressed air:

- In the molding department, supplying all air for pneumatic rammers, all squeeze and jolt machines, automatic set-out and lifting apparatus of mold conveyors, automatic shake-out machines, mold cleaning and spraying equipment.
- In the core department, for ramming equipment, spraying and torch drying equipment, core oven operation as well as core blowing equipment.
- In the cleaning department, pneumatic chipping hammers and grinders, blacksmith requirements, sand-blasting, pressure testing and miscellaneous tools.
- In the heat-treating department, heat treating furnace operation and cooling equipment.

To get all the facts and engineering data, write today for Bulletin C-5A.

C-298
3662

VISIT US AT THE NATIONAL PLANT MAINTENANCE AND ENGINEERING SHOW, CHICAGO, JANUARY 27-30, BOOTH 959-961

FULLER COMPANY

138 Bridge St., Catasauqua, Pa.

SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORPORATION

Chicago · San Francisco · Los Angeles · Seattle · Kansas City · Birmingham

Fuller

PIONEERS OF HIGH-EFFICIENCY VANE TYPE ROTARY COMPRESSORS SINCE 1930

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See What Square D's Front-Connected *POWER-STYLE* Switchboards Offer!

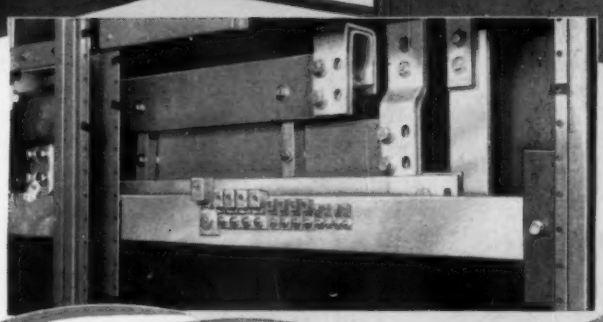
NEW!

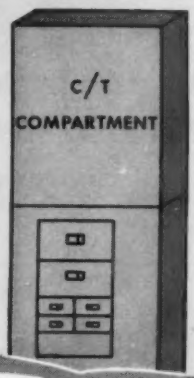
First *completely standardized* switchboard built specifically for small and medium-size installations. Bus bars designed to assure *cool operation in a depth of 14 inches!*

Complete *front accessibility* allows all bus bars and branch circuit connections to be installed and removed *from the front!* Permits mounting directly against wall.

Off-center mounting of breakers (or QMB fusible switches) in right hand section provides maximum room for installing cables from larger units.

Standardized C/T compartment built to meet Edison Electric Institute and Public Utilities' specifications.





Completely standardized horizontal bussing is available up to 2000 amperes, at either top or bottom. Notice bus bar drillings for extension to future sections.

Standardized C/T compartment designed to provide most flexible arrangement. Available in either "hot" or "cold" sequence, top or bottom feed. When used without main disconnect in "hot" sequence, up to six subdivisions can be mounted in same section with C/T compartment.

Write for descriptive bulletin
Address Square D Company, 6060 Rivard Street, Detroit 11, Michigan

SQUARE D COMPANY

For more facts circle 540 on Reply Card

OPERATION AND PRODUCTION —pointers for the industrial plant engineer

Edited by Vernon T. Kempf

Tester Prevents Steel Mix-up

INCOMING RAW MATERIALS are carefully checked to prevent low carbon steel coils from being mixed with shipments of high carbon coils at the Ramset Fastening System plant, Cleveland, Ohio. The coils are cold-headed into driving pins and threaded studs which are used to penetrate hard surfaces such as steel and concrete. These inspections are important because a low carbon steel fastener would probably fail.

Rapid testing of each coil is done with a Metal Monitor, manufactured by Brush Electronics, which is precise enough to distinguish between ASTM 1060 and 1062 series steels. The tester is a completely self-contained, portable unit built to be used by shop personnel with limited operational instructions.

Operation is based on the principle of comparing thermo-electric voltages generated between two electrodes and the metal being examined. A range switch allows selection of measurement sensitivities to reveal minute differences in chemical or physical properties.

Steel analysis is quickly checked with simple tester to prevent product failure

Chromium Carbide Reduces Wear

PISTON ABRASION, caused by fine sand particles, resulted in leakage and limited pump life to 600 hours at the Elyria Foundry Company, Elyria, Ohio, where a vertical power pump, generating water pressures up to 2200 psi, is used to clean sand castings. Although the pump was fitted with dust shields, and the water carefully filtered, fine sand particles caused constant and expensive maintenance of the close-fitting precision pump parts.

Each piston, made of 420 stainless, cost $42.50, and while it could be reground twice, pump downtime and labor for the grinding was expensive. New packing, at $7.30, was needed each time a piston was reground and, added to labor charges and overhead, raised the total cost to approximately $105.00 for the life of each piston, estimated at 1800 hours.

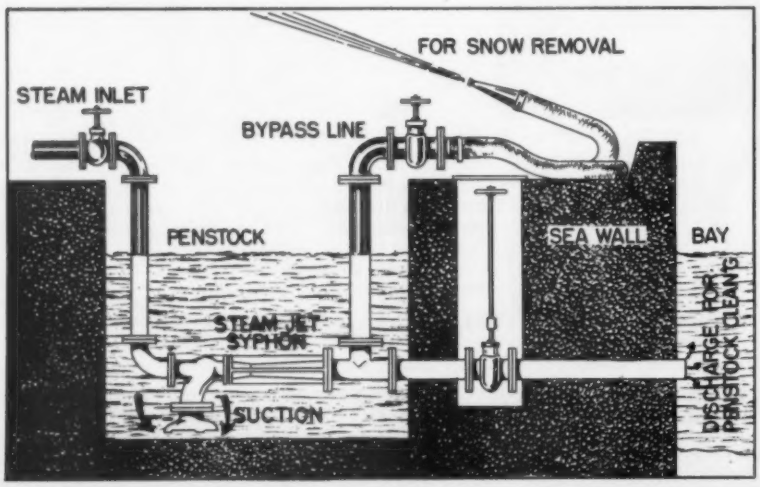
Chromallized carbon steel pistons were installed in the pump and have proved three times more durable and less expensive than those made of stainless steel. The Chromalloy process involves a high tem-

(Continued on page 56)

Steam Jet Syphon Makes Low Cost Pump and Snow Removal System

STEAM JET SYPHON removes water and sludge from a penstock at Gillette Safety Razor Company, making annual cleaning a more efficient, less costly operation.

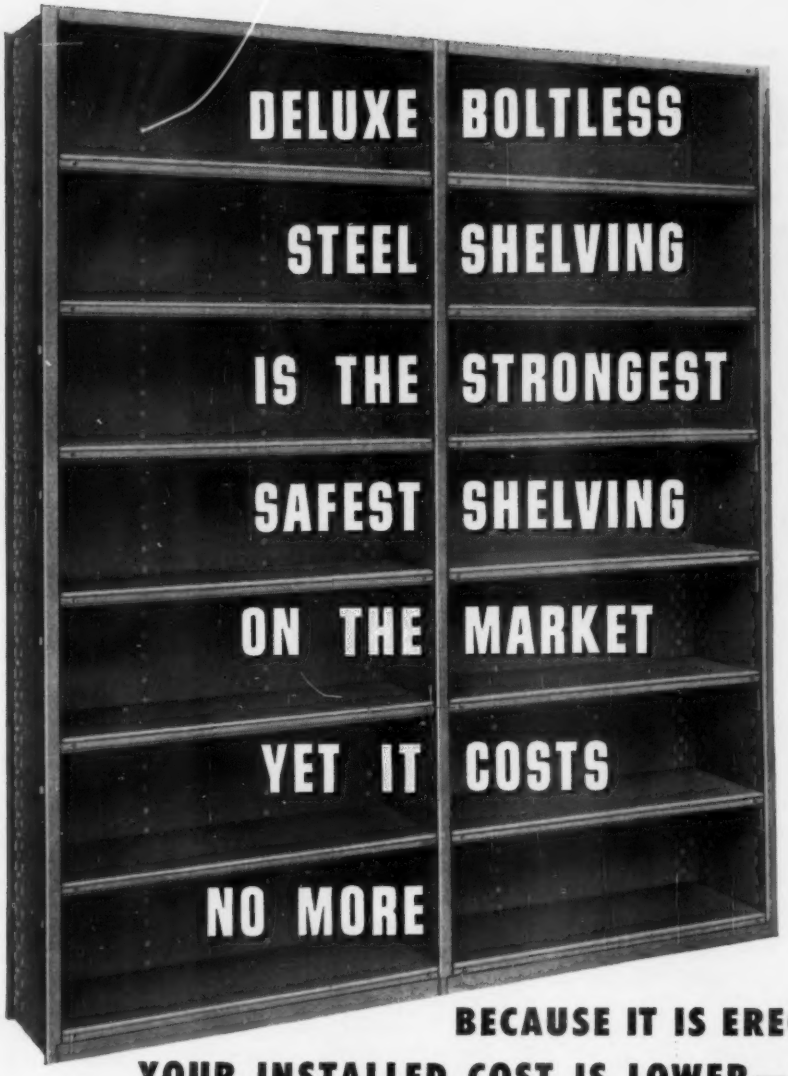
Prior to incorporating the jet apparatus, penstock silt removal was always an unhappy compromise between the factors of cost and frequency. Now it costs only about $120.00, including steam and labor, to clean the penstock annually. The syphon installation cost was approximately $500.00.



Steam at 175 psi, rushing through venturi, creates vacuum at suction opening. Penstock sludge and water is drawn into syphon, mixes with steam, and is carried out

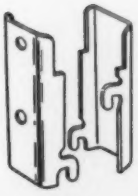
Heart of the installation is a Schutte and Koerting, five inch, steam jet syphon mounted permanently in a horizontal position with clearance for a short run of suction piping. Steam at 175 psi, introduced at the inlet nozzle, entrains penstock sludge and water and discharges into a tidal bay nearby. In keeping with the operating simplicity of the jet technique, the system requires a minimum of piping and valves.

The company uses this same apparatus to clear snow from its parking lots. With the discharge-to-bay line valve closed, and the bypass discharge line opened, as much as 500 ft of three inch fire hose can be connected to quickly melt and wash away snow accumulations that used to require 24 hr of work with a machine to clear.



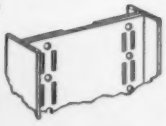
BECAUSE IT IS ERECTED FASTER YOUR INSTALLED COST IS LOWER—*HERE'S WHY*

BOLTLESS SHELF BRACKET



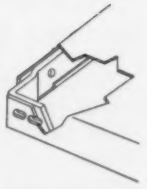
For easy adjustability, you merely insert four to a shelf—with absolutely no tools or special equipment needed.

ONE-PIECE BIN-TYPE UPRIGHT



Single upright member between sections provides faster erection, more rigid assembly. I-beam construction for greater strength.

FACTORY BUILT-IN SHELF REINFORCING



Reinforcing bars are imbedded in the shelves at the factory, eliminating many erection crew man hours and costly erection time.

OTHER DELUXE ERECTION TIME SAVERS

- Snap-in dividers
- Clip-on bin fronts
- Bottom shelf support and floor angle which permits shelving to be erected vertically in place.

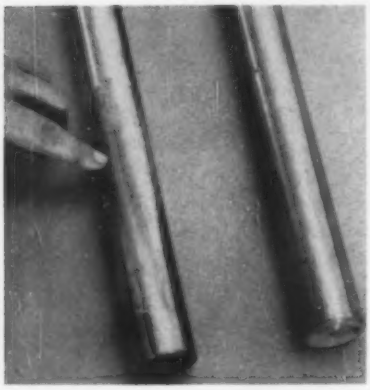
For assistance in planning your stockroom and other storage problems and for fast friendly shelving service, call your local Deluxe dealer. He's listed in the Yellow Pages, under *Shelving,* or write for name of dealer nearest you. See for yourself why Deluxe boltless steel shelving is strongest, safest, and fastest erected. Write for new Catalog No. 30. Deluxe Metal Furniture Company, Warren 7, Pa. A Division of Royal Metal Mfg. Co.

DELUXE
STEEL SHELVING

For more facts circle 541 on Reply Card

OPERATION—PRODUCTION

(O and P begins on page 54)



After 650 hours of service, abrasion of stainless steel pump piston, left, is compared to chromalloy piston, right

perature exchange of iron and chromium atoms at the surface of the part and provides it with a chromium carbide layer that is integral with the base metal.

Radiant Heat Reduces Losses

WARM AIR RADIANT HEATING, using a channel iron floor as the principal heat converter, is providing comfort heating and ventilation at a fraction of the estimated operating costs in a shipyard steel fabricating plant. This installation, a departure from the conventional "wet" radiant heating systems, is in a new 514-ft long, 82-ft wide and 54-ft high building of the Bath Iron Works Corp., Bath, Maine.

Design and construction of the building included a steel floor using 18-in. channel irons with flanges turned down onto six-inch channels set in concrete. There are three large access doors, 40 ft long and 30 ft high, on the side of the building facing the ship ways on the Kennebec River. With one or more of these doors open at frequent intervals, excessive heat loss was recognized as a major problem to be overcome, even before the building plans were started.

Bath Iron Works proposed using the channel irons in the floor as a set of ducts, which could be used as a warm air version of radiant heating for the finished structure.

Warm air is supplied by six floor-mounted Dravo Counterflo oil-fired forced air space heaters, each fitted with two 24-in. sheet metal ducts leading to trenches beneath the floor and then to an underground trench at the center of the building. From this trench, which extends the full length of the building, the warm air flows back to both side walls along the underside of the channel flooring, at which point it is released through side wall registers and drawn back to the heaters. This system assures controlled warm floors plus warm air supply and

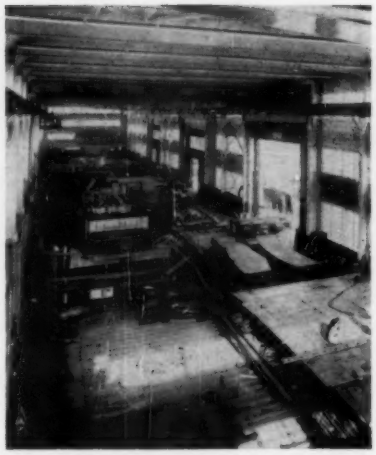


Fig. 1. Six heaters force 66,000 cfm of warm air through channels in the floor

recirculation in the working zone.

After one winter's experience with the system, Mr. Alfred M. Morton, Chief Plant Engineer, reported that a temperature of 55 F was easily maintained in the shop area with outside temperatures as low as minus 20 F. This was accomplished with a fuel consumption about 10 per cent less than expected.

The heating installation employs four 1,000,000-Btu per hr units with makeup air intakes, and two others of the same output capacity for recirculation of the shop's existing air. All six heaters discharge air at the rate of 11,000 cfm. In addition to the special ducts to the heat

(Continued on page 58)

New Wheel Reduces Maintenance of Rubber-Tired Pallet Trucks

RUBBER-TIRED PALLET TRUCKS operated by Leibmann Breweries in their Brooklyn, New York warehouses proved to be a troublesome maintenance problem. Used in an area sprinkled with broken glass, the maintenance staff had to replace them every four to six weeks.

In August 1956, Mr. A. E. Kingsley, Plant Engineer, installed a new type of wheel manufactured by Disogrin Industries, Inc., Jamaica, N. Y. The trucks were operated on a three-shift, seven-day week basis for six weeks. The tire diameter decreased 0.1 in. and did not show a cut or chewed appearance. The wheels have operated for an additional year and are still in good condition, as shown in Fig. 2.

Fig. 1. Pencil points to large gouge taken out of original rubber-tired wheel

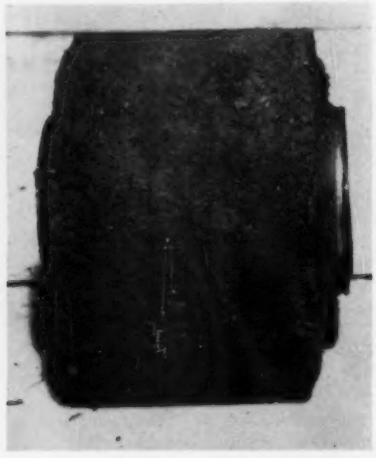


Fig. 2. New wheel, operated for a longer period, shows less wear than old one

Penetrates through rust
like coffee soaks into a sugar cube!

How much do you spend on removing rust before you paint? Why not coat right over the sound rusted metal with Rust-Oleum 769 Damp-Proof Red Primer after simple scraping and wire-brushing to remove rust scale and loose rust . . . saving time, money, and metal! Rust-Oleum's specially-processed fish oil vehicle penetrates* through rust to bare metal—while the surface film remains *tough, firm,* and *durable.* You cut costly surface preparations, you receive nearly 30% greater coverage depending upon the condition and porosity of the surface—and you receive the *maximum* in over-the-years protection!

Whatever your color choice may be—Rust-Oleum finish coatings include the color you want. They're manufactured under the same *exclusive* formulation as the Rust-Oleum Primer . . . they assure you of *greater* compatibility, *double* protection, and *lasting* beauty! The best way to see what Rust-Oleum will do for you is to actually try it yourself . . . around your plant or home.

See our complete catalog in Sweets, or send the coupon for a free Rust-Oleum Test Sample . . . one brushful means *more* than a thousand words. Prompt delivery from Industrial Distributor stocks.

*As proved by Battelle Memorial Institute Technologists in radioactive tracing studies.

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Distinctive as your own fingerprint. Accept no substitute.

STOPS RUST!®

ATTACH TO YOUR LETTERHEAD FOR FREE TEST SAMPLE!

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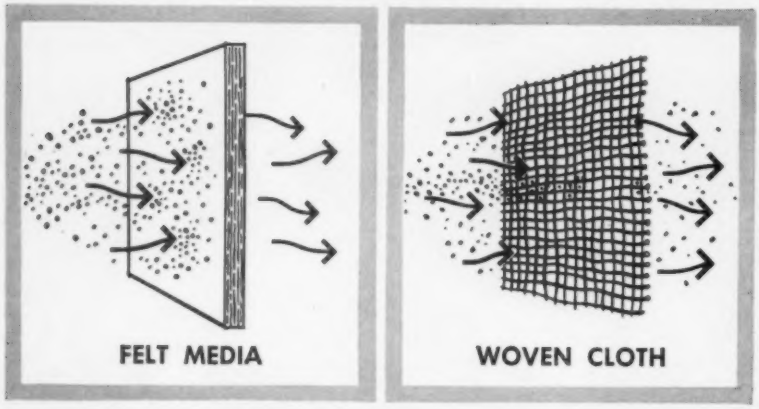
- ☐ Free test sample with complete literature
- ☐ 30-page report on Rust-Oleum penetration
- ☐ Nearest source of supply

For more facts circle 542 on Reply Card

DAY

DUST CONTROL NEWS



Here's why felt filter media traps dust BETTER!

This magnified view of filter media makes it easy to see why felt is more efficient than woven cloth. With cloth, the average opening between thread strands is above 10 microns. Felt, however, is made up of closely matted fibres and the air travels a tortuous path between the thousands of individual fibres. For all practical purposes, the resistance of these media is the same. That's why felt filtering media (wool or synthetic) is used exclusively in *all* filters made by DAY.

Consider this important fact. What happens when these two media are cleaned? Woven cloth is cleaned by shaking, rapping or low velocity reverse air. In many cases woven cloth is overcleaned, permitting leakage until openings between strands are again plugged with dust. The overall performance is one of erratic back pressure and filtering efficiency. *With DAY filters the porosity of the felt media is maintained by automatic counter flow air. Back pressure doesn't vary and peak filtering efficiency is constantly maintained.*

Whether your problem is collecting and recovering valuable dust or controlling dangerous or obnoxious dust; write for our free bulletin "DUST FILTER FACTS." Read this bulletin carefully before you decide on *any* dust filter. It contains useful charts and air engineering data. It also contains more information about the many services and equipment available from DAY. Write toDAY for Bulletin F-75.

The **DAY** *Company*

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The DAY SALES Company
807 Third Ave. N.E., Minneapolis 13, Minn

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P.O. Box 700, Fort William, Ontario

Representatives in Principal Cities

EQUIPMENT ONLY OR A COMPLETE SYSTEM

For more facts circle 543 on Reply Card

OPERATION—PRODUCTION

(O and P begins on page 54)

trench, the heaters are fitted with a center discharge nozzle delivering warm air directly to the work area.

Fired by No. 2 oil, the heaters are equipped with modulating type burners which automatically adjust the flame according to temperature requirements. Each of the heaters is individually controlled by a thermostat mounted on the wall near the unit it controls.

All of the units are set on raised shelves between the concrete piers

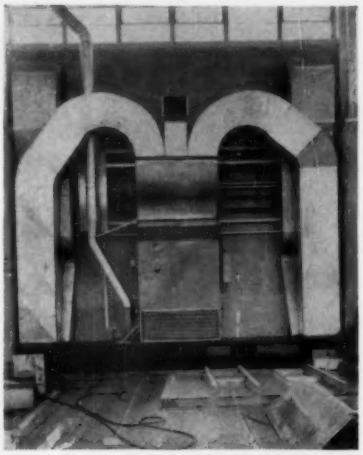


Fig. 2. Heater, with ducts at each side, feeds warm air to trenches under floor

that support steel columns and do not project out beyond these piers onto the clear working floor area.

Smoke and fumes from burning torches and welding equipment are vented by exhaust fans, and makeup air is brought into the building by the four heaters equipped with fresh air intakes. Dampers in the fresh air supply lines may be interlocked with louvered dampers controlling the air return from the shop area.

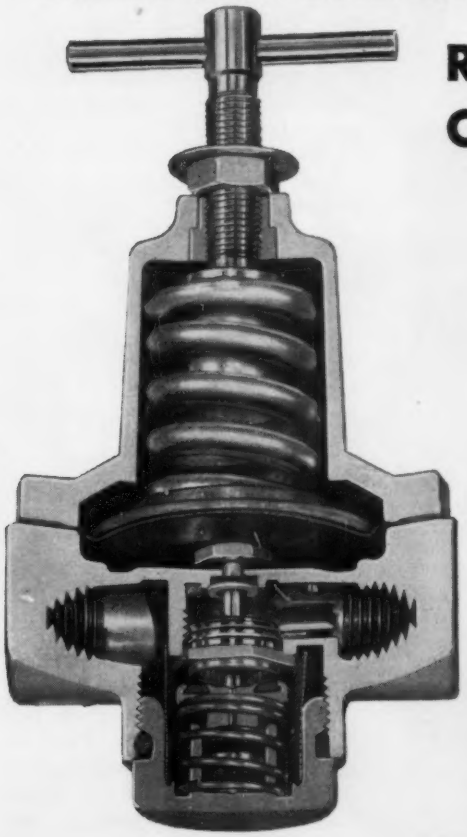
Tong Speeds Coil Handling

AUTOMATIC TONGS, suspended from an overhead crane, handle steel coils more quickly and with greater safety at the American Metal Products Company, Inc., Los Angeles, California.

Formerly the coils were carried to the storage area and stacked by fork trucks. This required spacer

FACTS about Norgren PRESSURE REGULATORS

Norgren Pressure Regulator on punch press at Shwayder Brothers, Inc., maker of Samsonite Luggage.



Reduce Air Costs . . . Cut Maintenance Costs

For any air operated equipment, there is one pressure at which it is designed to operate most efficiently. Above that pressure, equipment will wear excessively with no significant increase in output, and compressed air will be wasted. No matter what the application, you can choose a Norgren Pressure Regulator that will reduce line pressure to the desired working pressure. Results will include longer equipment life, lower maintenance costs, less down-time and savings in compressed air costs.

- **Norgren Pressure Regulators are Highly Accurate** over a wide operating range.
- **Regulated Pressure is Held Constant** even with widely fluctuating line pressure and rapidly varying air flow.
- **Flow Capacity is Large**—a. Balanced valve construction; b. Large effective diaphragm area; c. Improved baffle and siphon performance; d. Large passages; e. Large valve openings.
- **Choice of Relieving or Non-Relieving Regulators.**

For complete information on all your regulator needs ⅛" to 2" inclusive, call your nearby Norgren Representative listed in your telephone directory —or WRITE FACTORY FOR NEW No. 900 CATALOG.

C. A. NORGREN CO.

3443 SOUTH ELATI STREET • ENGLEWOOD, COLORADO

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Schramm Compressors provide air for chipping, cleaning, grinding, drilling, operating hoists and lifts, sand rammers, vibrators and molding machines.

ONE AIR COMPRESSOR USER REPORTS:

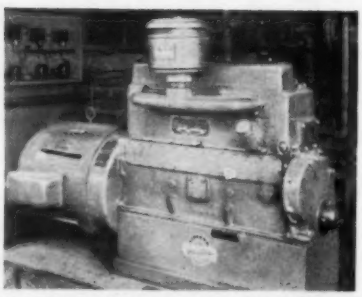
"Eight years of satisfactory service and not a cent for repairs"

In modern foundry and steel mill practice, where compressed air is indispensable, Schramm Industrial Compressors are establishing new records for continuous, trouble-free performance.

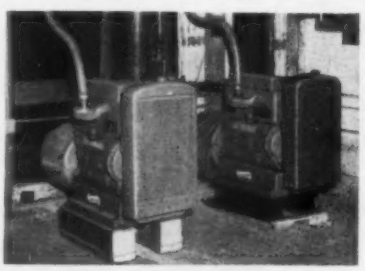
Schramm Compressors set performance records because they incorporate many design features found in no other machine. Balanced reciprocating parts give vibrationless operation, permit out-of-the-way installation without special foundations. Schramm engineered cooling systems—air blast for units delivering 50 cfm of free air, or less; liquid cooling for larger sizes—provide adequate cooling for full load, permitting continuous operation.

The economic advantages of buying Schramm Industrial Compressors are outstanding. Initial cost, compared with other compressors delivering the same amount of free air, is low. Maintenance of Schramm Compressors is no problem—any mechanic who understands gasoline engines understands Schramm Compressors.

Write today for free literature.



JACKETED LIQUID COOLING SYSTEM. Units delivering 85 cfm and over are jacketed for liquid cooling. Furnished with inlet and outlet flanges or Schramm cooling unit.



NO FOUNDATIONS. Schramm balanced design permits installation without expensive foundations. Units can be set up in almost any out-of-the-way location.

Schramm, Inc.

MANUFACTURERS OF AIR COMPRESSORS

665 North Garfield Ave. • West Chester, Pa.

For more facts circle 545 on Reply Card

OPERATION—PRODUCTION

(O and P begins on page 54)

Clamps on inside and outside diameters lift heavy coils without damage

blocks between coils to allow the forks of the trucks to get under them. The blocks were positioned by hand, taking time and creating a safety hazard.

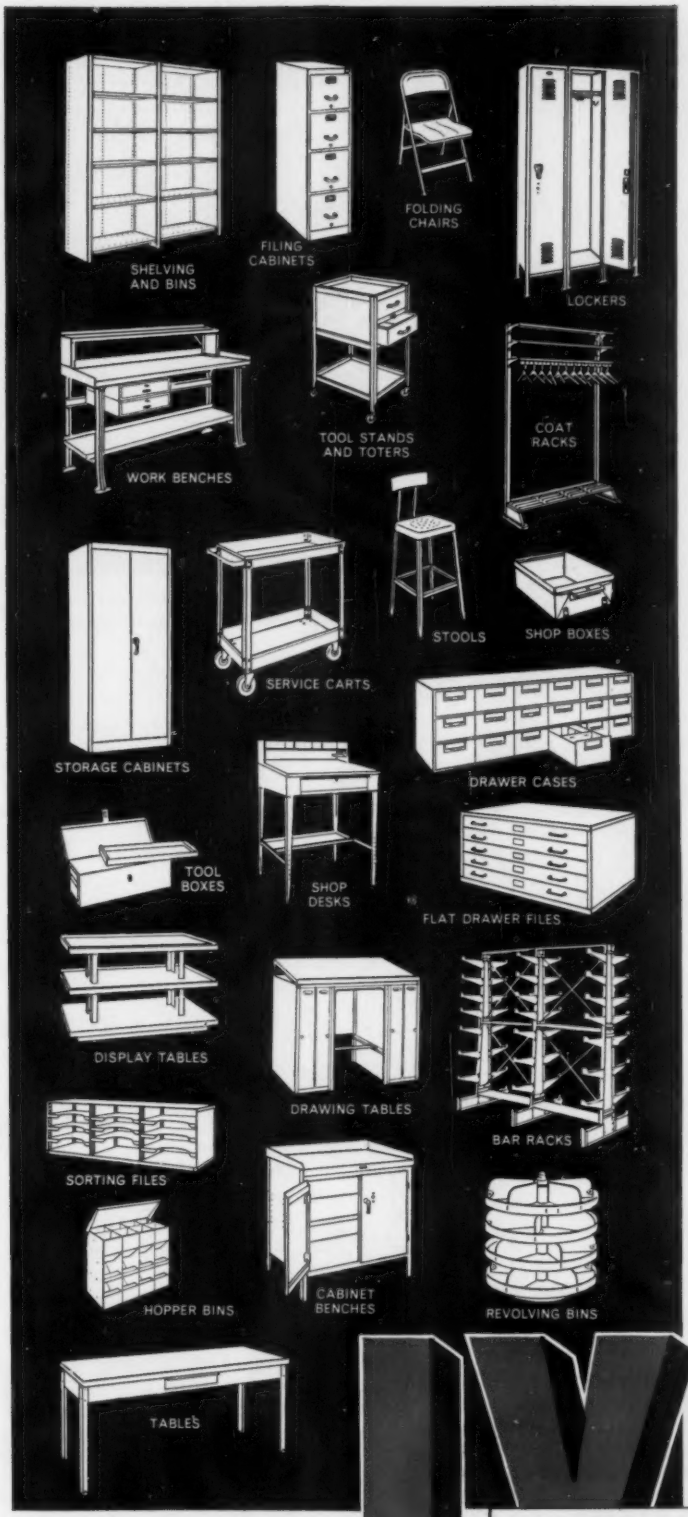
Use of tongs, manufactured by the Heppenstall Company, New Brighton, Pa., permit the coils to be positioned without the spacer blocks. This allows an additional tier of coils to be stored in the same amount of space.

The tongs are lowered over the coil with their jaws locked open, one jaw in the space in the center of the coil and the other outside the coil. When the tongs are raised, the jaws close automatically, holding the coil firmly. When the coil is lowered at its destination, it is only necessary to lower the tongs a few additional inches to lock the jaws open, releasing the load.

Double Storage Capacity

ADDING A SECOND STORY of eight foot high bins, doubled the storage capacity of the warehouse area at The Osborn Manufacturing Company, Cleveland, Ohio. Steel catwalk aisles run between the bin tiers and along the outside of the racks.

There are 55 racks which hold from 42 to 202 tote pans. These are used to store bushings, lock washers, nuts, machine bolts and cap screws. Manufactured stock parts are also



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for Business, Industry, Institutions

FIRST
IN QUALITY DESIGN

FIRST
IN BUYER PREFERENCE VOTED 5 TO 1

FIRST
IN RANGE OF PRODUCTS MORE THAN 1500 ITEMS

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See Your LYON Dealer!

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Lyon also has complete facilities for manufacturing special items to your specifications

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STEEL EQUIPMENT

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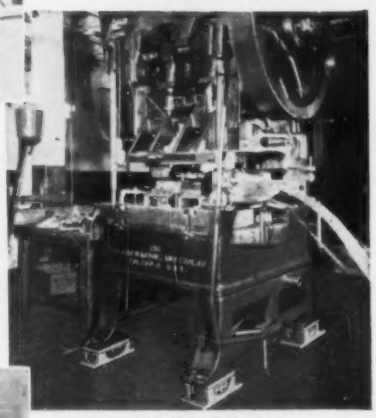
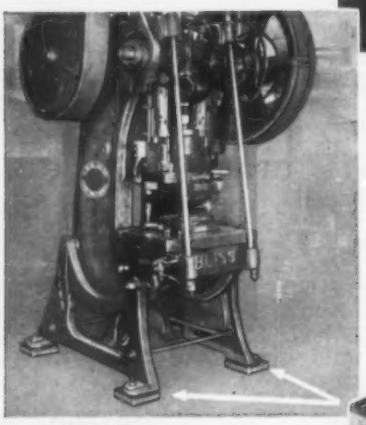
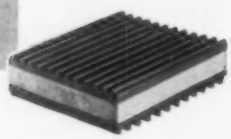
STOP VIBRATION *with* KORFUND VIBRATION CONTROL



A TOUGH PROBLEM solved by specially designed Korfund Steel Spring Vibro-Isolators. Shock from this 100,000# 600 ton capacity press was cracking building walls. Four specially designed 25,000# capacity Korfund Steel Spring Vibro-Isolators, themselves weighing 600# each, were installed under the press. Building damage stopped and heavy production schedules were maintained. Yet, the price of the special Korfund Isolators was less than 3% of the press cost.



AN AVERAGE PROBLEM—typical of those solved every day by Standard Korfund Steel Spring Vibro-Isolators. Vibration and noise from this double crank press, which could be felt and heard throughout the building, were stopped by Standard Korfund Steel Spring Vibro-Isolators. More and more manufacturers are discovering how Korfund Vibro-Isolators permit press installation without reinforcement of floors, permit press installation *anywhere* (even near precision equipment) for better plant layout, increase press speed and production, improve quality.



A SIMPLE PROBLEM solved inexpensively and *effectively* by Korfund Elasto-Rib Pads. In this case, Elasto-Rib Pads installed under each of the legs of this press stopped transmission of vibration and noise. For the less critical installation, Korfund Elasto-Rib Pads provide low-cost, *effective* vibration and noise control, and eliminate bolting to the floor.

PUNCH PRESSES are notorious for the amount of vibration and noise they transmit—yet in the three cases illustrated, Korfund Vibration Control units successfully solved the problem. In our files are scores of case histories describing equally satisfactory installations on many other types of machinery.

A selector chart is available giving recommendations for various vibration control problems. Write for your copy of Bulletin No. 13, or see our catalog in Sweet's Files.

For specific recommendations, contact us or the Korfund representative you'll find in most principal cities. A half-century of experience is at your disposal.

THE KORFUND CO., INC.

KORFUND VIBRATION CONTROL — SPRINGS — RUBBER — CORK

48-35R Thirty Second Place, Long Island City 1, N. Y.
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal

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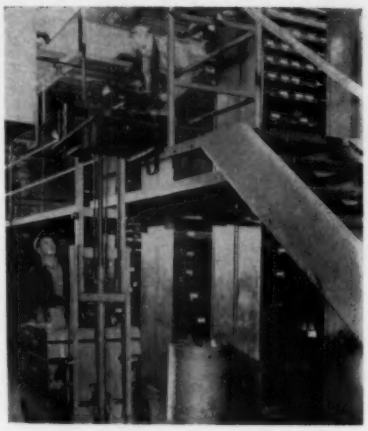
OPERATION—PRODUCTION

(O and P begins on page 54)



Pallet loads of materials are lifted to second level to speed up stock transfer

stored in this area prior to use.

Operating in a seven foot aisle, an Automatic electric fork truck raises materials to the upper level.

$10.00 Reward

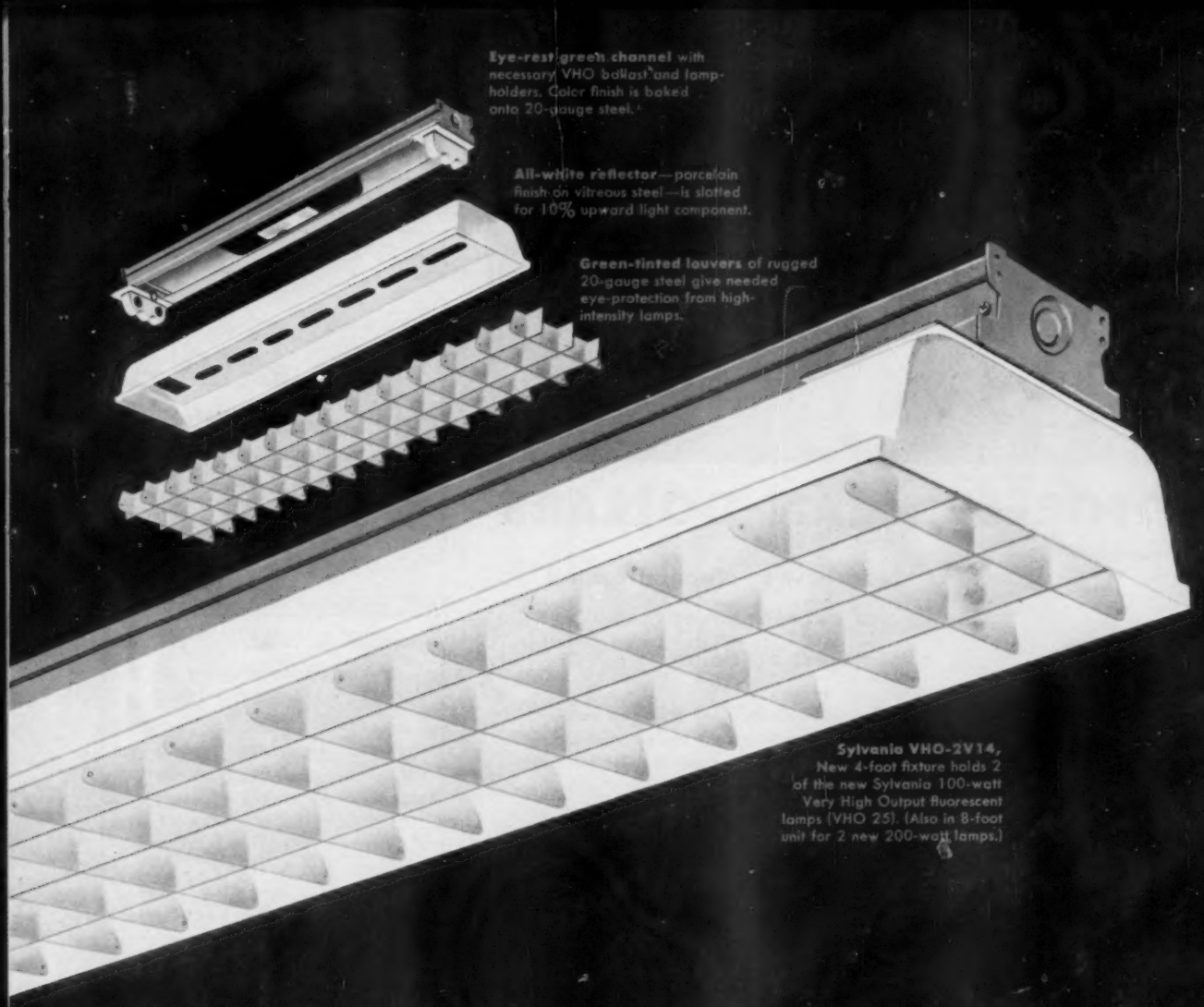
WANTED . . . . Items of interest to plant engineers.

PLANT ENGINEERING will pay $10.00 minimum for each item accepted for publication. These items should describe a useful improvement or modification to plant equipment and buildings or more efficient use of any facilities. Where applicable, items should be accompanied by a sketch and/or a photograph. Send all entries to Editor, PLANT ENGINEERING, 308 East James Street, Barrington, Illinois.

Signals Stop Lost Welding Time

LOCATING INSPECTORS for first-piece inspection and truckers to remove finished production orders caused considerable waste of welders' time at the Barrett-Cravens Company, Brookfield, Illinois. To eliminate this lost time, signals were installed to call the inspector or trucker to the welding booth.

The signals consist of two standard four-inch octagon boxes, with


Eye-rest green channel with necessary VHO ballast and lamp-holders. Color finish is baked onto 20-gauge steel.
All-white reflector—porcelain finish on vitreous steel—is slotted for 10% upward light component.
Green-tinted louvers of rugged 20-gauge steel give needed eye-protection from high-intensity lamps.
Sylvania VHO-2V14, New 4-foot fixture holds 2 of the new Sylvania 100-watt Very High Output fluorescent lamps (VHO 25). (Also in 8-foot unit for 2 new 200-watt lamps.)

NOW—Light Output Doubled!

New Sylvania VHO Special Fixture Series

for quality lighting with the sensational new fluorescent lamp

Sylvania's new VHO Special Fixture Series harnesses the tremendous light output of the sensational VHO lamps and puts it to work effectively for you.

These higher wattage VHO lamps—recently developed in the Sylvania laboratories—mark a milestone in today's industrial lighting revolution. Though no larger in size, they deliver more than double the light output of regular fluorescents of the same length.

Sylvania's new VHO Special Fixture operates these lamps with a minimum of glare and a maximum of eye comfort. Its "eye-rest" green channel and green tinted louvers add cool chromatic eye-comfort. Its white porcelain reflector is slotted for 10% upward light component to mellow harsh contrasts overhead.

Picture, in your own plant, where these fixtures might work effectively for you . . . in inspection areas or precision machine locations . . . for close tolerance work or for general high-bay areas.

See for yourself what Sylvania's new VHO lighting can do for morale and plant production rates, reducing the number of rejects. See how its one-man maintenance features will cut down operating costs. Talk to your local Sylvania Fixture Specialist, or write direct for full details.

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One 48th Street, Wheeling, W. Va.

SYLVANIA
...fastest growing name in sight

LIGHTING • RADIO • ELECTRONICS • TELEVISION • METALS & CHEMICALS

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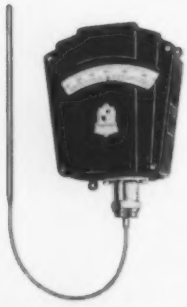
DEGREES MEAN DOLLARS



Partlow Temperature Indicating Control

Partlow Temperature Recording Control

Partlow's "pinpoint control" of degrees saves processing dollars

Partlow Controls are protecting materials and equipment in more and more processing operations where maintenance of accurate temperatures is vital.

Available in recording, indicating and non-indicating models, they provide positive, precise temperature control for processes using either gas, oil, steam or water valves, or electrical equipment.

Partlow Controls have a reputation for dependability and long life. Actuated by mercury, they are ruggedly built to withstand shock and vibration without loss of accuracy. Many have been in service for 20 years or more.

Available in ten scale and element ranges, from –30°F. to 1100°F.

Tell your process problems to Partlow. Our Engineers will gladly work with you.

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THE PIONEER IN MERCURY THERMAL CONTROLS

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We are interested in Partlow Controls for the following applications:

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☐ Have representative call. ☐ Send us data on Partlow Controls suitable for applications described above.

Company.....

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City.....State.....

Signed_____

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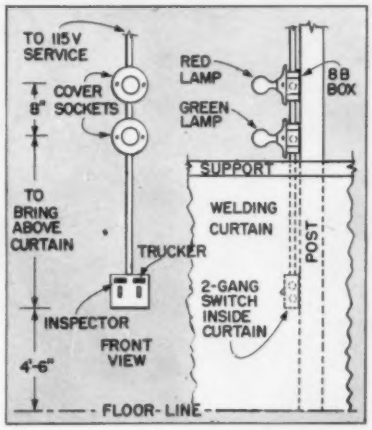
OPERATION—PRODUCTION

(O and P begins on page 54)



Signals can be installed at low cost

cover sockets, mounted above the welding booth curtain. A two-gang switch box is mounted inside the curtain at a convenient height. Nameplates identify the switches as inspector and trucker. Any colored bulbs can be used, such as amber for trucker and green for inspector. When a weldor needs either one of these services, he operates the correct switch and continues with his work. The inspector or trucker turns the light off when he arrives at the booth.

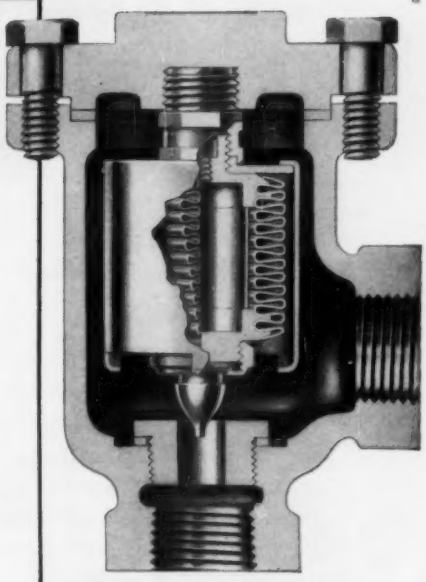
Balance Reel Speeds Assembly

Pneumatic nut-runners, on transmission assembly line, are supported from wire rope balance reels. Suspension pulls tools out of working area when not in use. Installation is at the New Process Gear plant, in Syracuse, New York

Proven by performance!

All departments agree on operating efficiency of SARCO Thermostatic Steam Trap

	MAINTENANCE	PURCHASING	STORES
1. **Same head and seat for 0-300 psi** — no changing of heads and seats for varying loads and pressures.	✓	✓	✓
2. **Fewer parts to stock** — same bellows, head and seat for 0-300 psi.		✓	✓
3. **Greatest capacity per dollar cost** — 1" size discharges 9,650 lbs/hr at 10°F below steam temperature, 125 psi.		✓	
4. **Very compact and light** — ¾" size fits in palm of the hand. Weighs only 3¾ lbs.	✓		
5. **Freeze-proof**—wide open, self-draining when cold.	✓		
6. **Only one working part** — the thermostatic element. Can be inspected or replaced in few minutes without moving trap from line.	✓		



SARCO

Balanced Pressure

THERMOSTATIC STEAM TRAP

Same seat and head
for all pressures to 300 psi

•

Sizes ½" to 2"

•

Write for Bulletin 250

Proven by testing!

Steam-tested — every single Sarco Thermostatic is steam-tested at rated maximum pressure.

Proven "on-the-job" performance — maximum fatigue-resistance for every thermostatic element is assured by Sarco's exclusive helical corrugating process and fatigue testing method.

Quality Control — every step of manufacture under exacting tests and controls . . . in Sarco's own plant.

Proven by experience!

During past 40 years, over 1,000,000 Sarco Thermostatics have been installed in countries throughout the world!

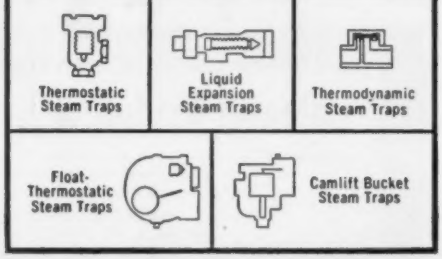
Sarco Company, Inc., 635 Madison Ave., New York 22, N.Y.

AN AFFILIATE OF SARCOTHERM CONTROLS, INC.

2212-B

Only Sarco Makes All 5 Types

. . . that's why Sarco can give impartial advice on trap selection



STEAM TRAPS • TEMPERATURE CONTROLLERS • STRAINERS • HEATING SPECIALTIES

For more facts circle 550 on Reply Card

Fire Protection for UARCO Inc.

includes 1,138 sprinkler heads, five fire hydrants . . . and a HORTON ELEVATED TANK

If fire breaks out anywhere in the 63,885 square feet of the modern UARCO plant at Watseka, Illinois, there is always 100,000 gallons of water ready to flow from a Horton® elevated tank to the nearest hydrant or sprinkler head. The Horton ellipsoidal-bottom elevated tank holds this water day and night, ready to flow by dependable gravity pressure the moment it is needed.

A Horton elevated tank connected to an automatic sprinkler system provides maximum plant protection. Water is available day and night to quench fires *before* they cause widespread damage. *No plant can afford a fire!*

Write our nearest office for further information, estimates or quotations on Horton elevated tanks.

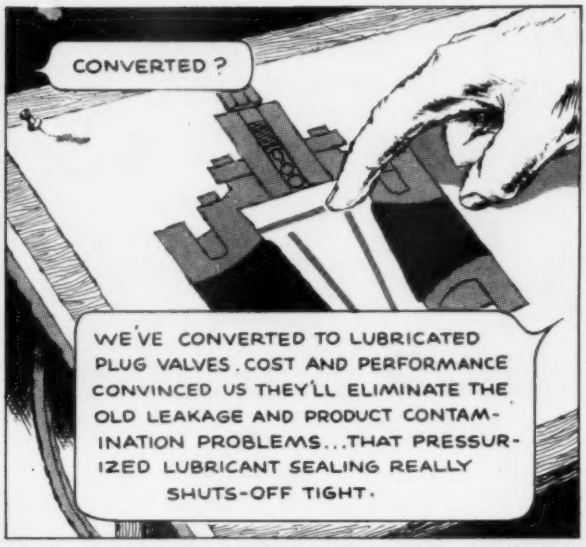
CBI

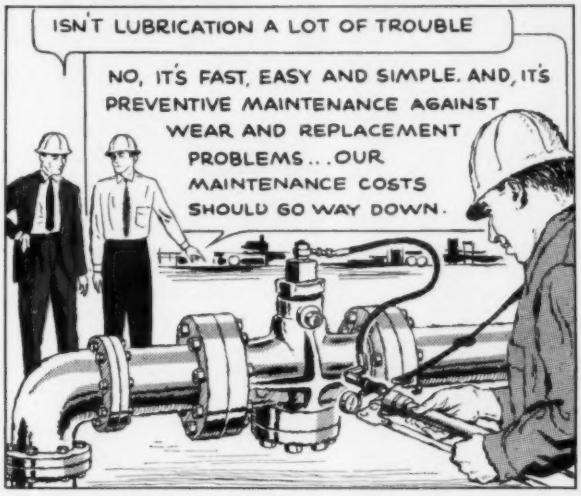
Chicago Bridge & Iron Company

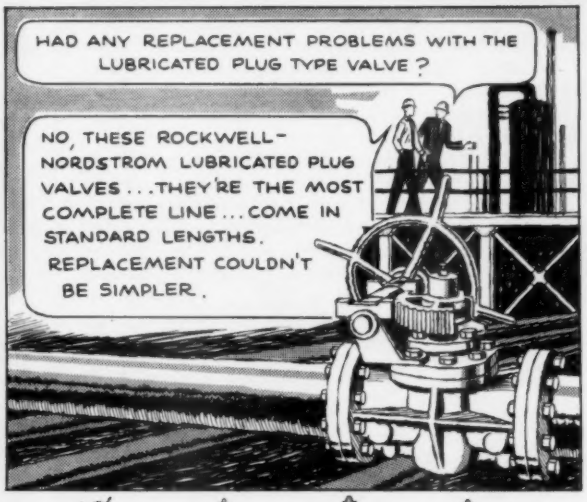
Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
New Orleans • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • South Pasadena • Tulsa
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY, GREENVILLE, PA. and NEW CASTLE, DEL.

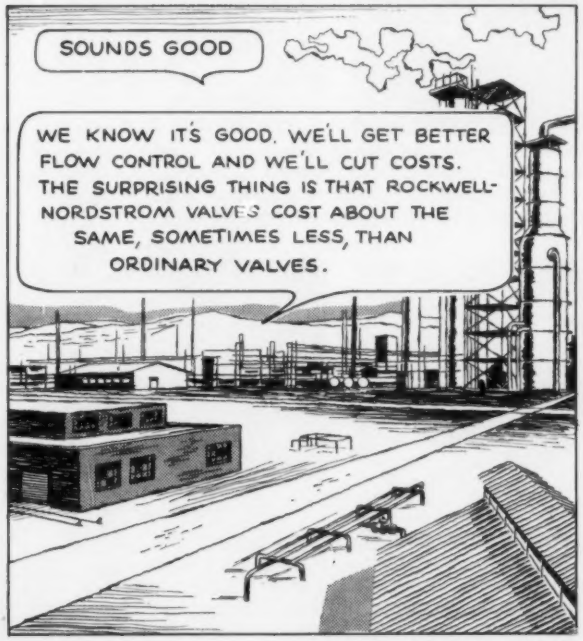
COST CUTTING IN ACTION

by Rockwell-Nordstrom


CONVERTED?
WE'VE CONVERTED TO LUBRICATED PLUG VALVES. COST AND PERFORMANCE CONVINCED US THEY'LL ELIMINATE THE OLD LEAKAGE AND PRODUCT CONTAMINATION PROBLEMS...THAT PRESSURIZED LUBRICANT SEALING REALLY SHUTS-OFF TIGHT.


ISN'T LUBRICATION A LOT OF TROUBLE
NO, IT'S FAST, EASY AND SIMPLE. AND, IT'S PREVENTIVE MAINTENANCE AGAINST WEAR AND REPLACEMENT PROBLEMS...OUR MAINTENANCE COSTS SHOULD GO WAY DOWN.


HAD ANY REPLACEMENT PROBLEMS WITH THE LUBRICATED PLUG TYPE VALVE?
NO, THESE ROCKWELL-NORDSTROM LUBRICATED PLUG VALVES...THEY'RE THE MOST COMPLETE LINE...COME IN STANDARD LENGTHS. REPLACEMENT COULDN'T BE SIMPLER.


SOUNDS GOOD
WE KNOW IT'S GOOD. WE'LL GET BETTER FLOW CONTROL AND WE'LL CUT COSTS. THE SURPRISING THING IS THAT ROCKWELL-NORDSTROM VALVES COST ABOUT THE SAME, SOMETIMES LESS, THAN ORDINARY VALVES.

ROCKWELL-Nordstrom VALVES

it's **ROCKWELL**

MANUFACTURING COMPANY

Rockwell-Nordstrom valves are available in a complete range of sizes and ratings in semi-steel, steel, stainless steel and other corrosion resisting metals.

Send Coupon For Free Literature

Rockwell Manufacturing Company
Rockwell-Nordstrom Valve Division
Department CS Pittsburgh 8, Pa.

☐ Please send me complete information on Rockwell-Nordstrom valves for process, industrial and manufacturing flow control.

☐ Please send me the name of your nearest distributor . . . ask him (to) (not to) call immediately.

Name_____ Title_____

Firm_____

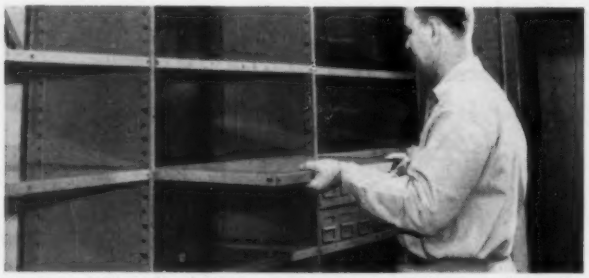
Street_____

City_____ Zone_____ State_____

For more facts circle 551 on Reply Card

Only New HALLOWELL *ERECTOMATIC*® Steel Shelving

has a time-saving, positive built-in lock—plus these features:



FAST ASSEMBLY. Just position the shelf supports, insert the shelf, press the locks. Straight-in, straight-out shelf change. No tilting. No dismantling. No interference with any other shelf.

New Hallowell ERECTOMATIC® steel shelving goes up fast, can be rearranged in seconds. It's the unique built-in locking device* that cuts assembly time, speeds repositioning of shelves. Here's how easy it is! To position a shelf—slide it into place on the shelf supports, press the locks, and the job is done. To reposition a shelf—release the locks, pull the shelf straight out, slide it straight in on the supports at its new location, and press the locks. It takes only seconds to complete the move.

New Hallowell ERECTOMATIC steel shelving is available in all types, too. Open, closed, bin units, ledge units, counter units, and cabinets are made of prime steel, phosphate coated, and finished in baked-on enamel. Standard is SPS green, other colors are available.

Investigate new Hallowell ERECTOMATIC before ordering shelving. You'll find it stocked by leading industrial distributors and shop equipment dealers everywhere. Contact the one nearest you. Or write Hallowell Shop Equipment Division, STANDARD PRESSED STEEL CO., Jenkintown 26, Pa.

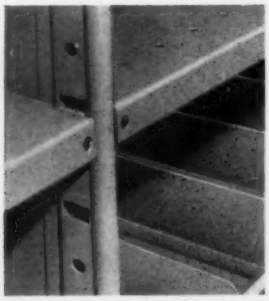
*Patent applied for

See us at the Plant Maintenance and Engineering Show in Chicago — Jan. 27-30, Booth No. 835.

INDEPENDENT SHELF POSITIONING. Each shelf can be individually repositioned in seconds.

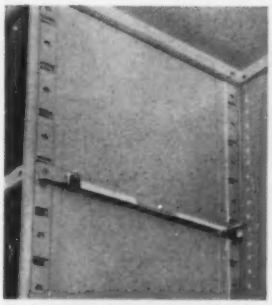
FULL USE OF SHELF AREA. No tees or angles, and beaded posts save valuable space.

COMMON SIDE PANELS AND POSTS save material between adjacent units in rack. Back and side panels are one-piece.



BEADED POSTS AND FLANGED SHELVES prevent snagging of clothing or stored goods, protect workers.

QUICK SHELF CHANGE. Release the locks, remove the shelf and its supports, relocate, and press the locks.



FULL DEPTH SHELF SUPPORT. No buckling possible. Reinforcements can be added when they are required.

4 CLASSES OF SHELVES. Regular, medium, heavy and extra-heavy construction meets all load requirements.

HALLOWELL® SHOP EQUIPMENT DIVISION

STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN PENNSYLVANIA

For more facts circle 552 on Reply Card

For more facts circle 553 on Reply Card →

Handle Flammable Liquids
In the Approved **Safe** Way

EAGLE SAFETY CANS

The COMPLETE Line

UI-2 — 1 QT.

- Available in 5 sizes from 1 qt. to 5 gal.
- No waste, no splash, no spill.
- Self-adjusting guard cap prevents leakage.
- Bottoms reinforced with heavy steel hoop.
- Non-flash-back safety screen available for all models. Flexible-Funnel attachment available for 1, 2½ and 5 gal. units.
- 1 qt., 2 qt., 1 gal. sizes come with trigger-grip handle—2½ and 5 gal. sizes feature free-swing handle.
- Safe for handling all flammable liquids.

UI-4 — 2 QT.

UI-10 — 1 GAL.

Eagle Safety Cans are approved by Underwriters' Laboratories, Inc. and by Factory Mutual.

UI-25 — 2½ GAL.

UI-50 — 5 GAL.

Eagle Safety Cans have strong 1-piece construction; no seams.

UI-50S — 5 GAL.
WITH SAFETY SCREEN

UI-50F — 5 GAL.
WITH FLEXIBLE FUNNEL

ORDER APPROVED Eagle Safety Cans from your supplier or write direct to Eagle for information.

WRITE for latest Eagle Catalog showing the Complete Line of Eagle Oilers; Safety, Oil, and Gasoline Cans; and Containers. It's free.

EAGLE MANUFACTURING CO. Wellsburg, West Virginia

Serving Industry Since 1894

HYDRAULIC PUMP OILERS

Keep moving parts of machines and other large equipment running smoothly . . . flexible, straight or angle spouts.

#33 ALL-PURPOSE PUMP OILERS

Dependable, reasonably-priced . . . for many lubrication needs in factory, machine shop, warehouse . . . also available with flexible spouts.

SAFETY CANS

approved by Underwriters' Laboratories, Inc. and Factory Mutual . . . safe for handling of flammable liquids . . . trigger or free-swing handle type.

USE EAGLE INDUSTRIAL OILERS and CANS

The Complete Line

Eagle high-quality oilers and cans are made in all styles and sizes for every factory purpose. Efficient design and sturdy construction assure economical, lasting service.

Order EAGLE cans and oilers from your supplier or write direct to Eagle for information.

WELDED STEEL SUPPLY CANS

Storage and filling cans for railroads, mills, factories, mines, foundries.

WELDED STEEL BENCH OILERS

For heavy factory use . . . flexible or straight spouts . . . optional seal tip prevents leaking.

#99 SEAL-TIP TOOL KIT OILERS

Handy for all tool kits . . . for oiling meters, gauges, and many other factory uses.

#66 ALL-PURPOSE PISTOL GRIP OILERS

Modern-design oilers of many uses . . . spark-proof . . . delivers one drop or a full stream of oil . . . also available with flexible spouts.

GALVANIZED OIL CANS

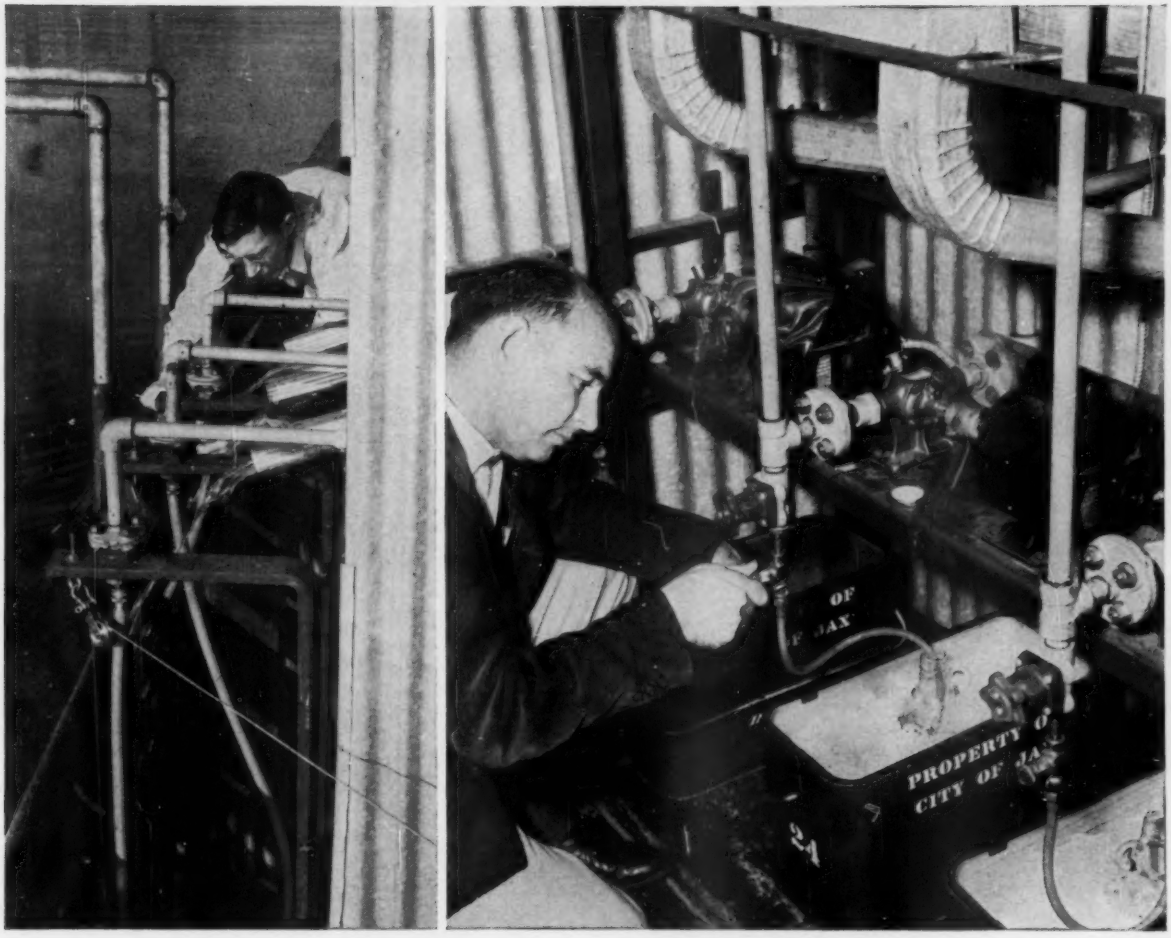
One piece seamless drawn dome shaped body . . . no top seam . . . no side seam . . . made from 26 gauge galvanized steel sheets . . . ideal for rough use and unlimited service.

Write For latest Eagle Catalog showing the Complete Line of Eagle Oilers; Safety, Oil, and Gasoline Cans; and Containers. It's Free.

EAGLE **MANUFACTURING CO.** Wellsburg, West Virginia

Serving Industry Since 1894

B.F.Goodrich



Koroseal helps analyze water in St. Johns River

IN a small building atop the Main Street bridge in Jacksonville, Florida are three motor-driven paddle pumps. Their job is to suck up water from the St. Johns River at three different depths—3, 38 and 72 feet—for use in continuing year-after-year laboratory analyses.

But chlorine content of the water runs high—reaching a maximum of 12,000 PPM at times—and so the pipes had to have unusual resistance to chlorides. That's why the City of Jacksonville chose B.F.Goodrich rigid Koroseal PVC pipe, valves and fittings. City engineers report continuous trouble-free operation.

Unusual application? Yes, but Koroseal rigid polyvinyl chloride pipe now provides excellent service in countless unusual applications where standard metal piping is inadequate. It's unaffected by most alkalies and acids, and is completely inert in the presence of oil, alcohol, and salt solutions. Unusually strong, it has high impact resistance and is available in tubes, rods, valves and sheets.

Other reasons for the growing popularity of Koroseal PVC are low initial cost . . . ease of installation . . . light weight . . . economical maintenance. It can be threaded, cut, welded or drilled —and never needs painting.

To get more information on how Koroseal can make your operation more efficient and profitable, fill in and mail the coupon to your right.

B.F.Goodrich
INDUSTRIAL PRODUCTS

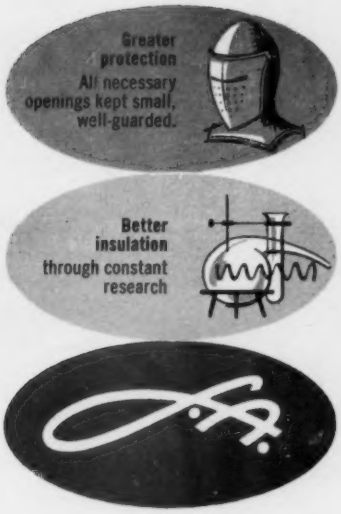
B.F.Goodrich Industrial Products Co.
Dept. PE-1
Marietta, Ohio

Please send me free booklets on:
- ☐ Rigid Koroseal Pipe
- ☐ Rigid Koroseal Sheet

Name_____
Company_____
Address_____
City_____ Zone____ State_____

Koroseal—T. M. Reg. U. S. Pat. Off.

For more facts circle 554 on Reply Card



They look like twins — but one is synchronous

Louis Allis "Syncro-Spede"* offers—for the first time—a synchronous motor in the same frame sizes as a standard induction motor

New from Louis Allis — *the most compact and efficient synchronous induction motor on the market* . . . the revolutionary "Syncro-Spede." It's the *only* synchronous motor built in standard NEMA frames for comparable ratings in any enclosure.

The space-saving "Syncro-Spede" has no external excitation, wound rotating fields, collector rings or brushes—offers simplified control and low-cost operation, virtually maintenance-free.

In performance, "Syncro-Spede" delivers and maintains exact synchronous speed within its rated capacity, regardless of load variations or voltage dips. When powered by a single adjustable frequency source acceleration, running speed, and deceleration of several different ratings of "Syncro-Spede" motors can be synchronized.

"Syncro-Spede" is the low-cost answer to such demanding synchronous applications as *precise adjustable-frequency multi-motor systems* . . . high-frequency generator drives and constant-speed conveyor drives . . . precision timing and metering devices . . . recording instrument drives . . . any system requiring constant speeds from no-load to full-load.

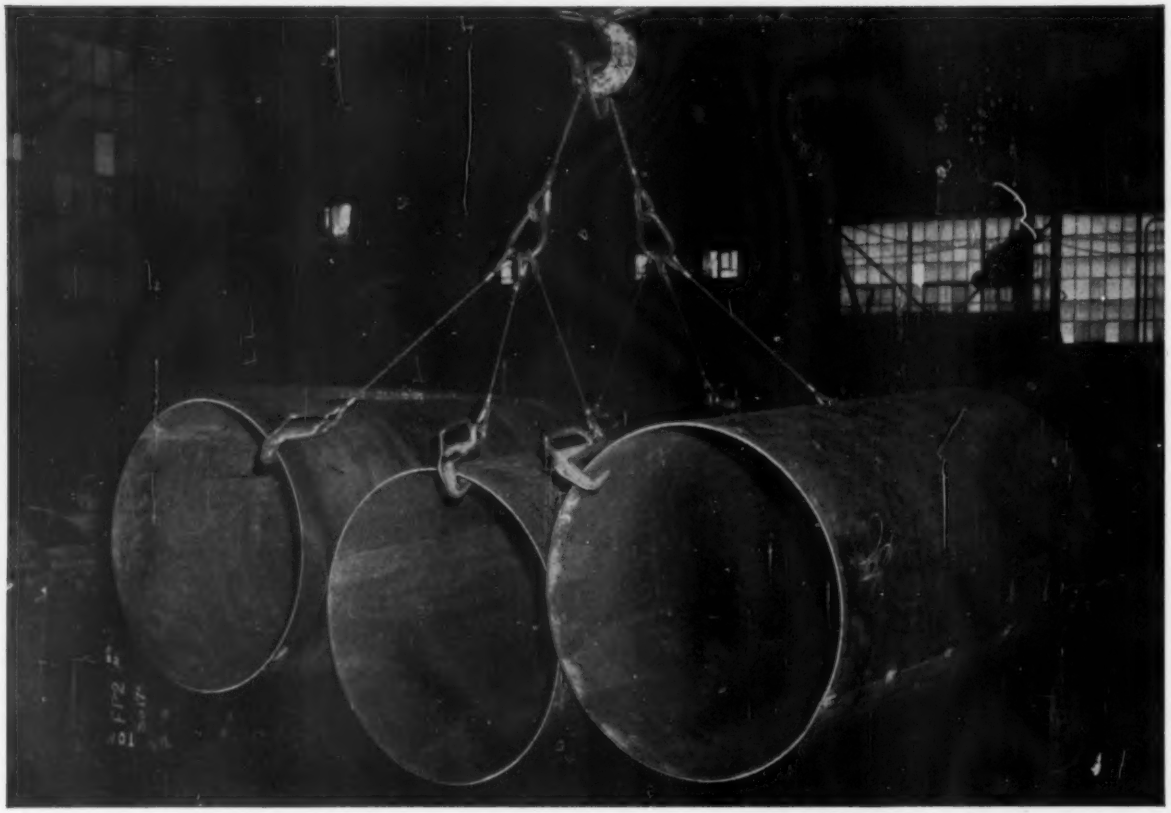
"Syncro-Spede" sizes range up to 100 hp. For information and expert application engineering assistance, contact your nearby Louis Allis District Office or write directly to The Louis Allis Company, 434 East Stewart Street, Milwaukee 1, Wisconsin.

*"Syncro-Spede" is a trademark of the Louis Allis Co.

LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

For more facts circle 555 on Reply Card



Tuffy·

Slings and Hoist Lines

now...thanks to Tuffy...three make the trip instead of one

The Toronto Iron Works makes tanks on a production line basis. Plate steel is rolled and welded into 8′-long tank sections at one end of the plant. The sections are picked up by an overhead crane and transported to the far end for final assembly. Formerly they were carried on a chain... a single section per trip, tying up the crane all day.

In the course of a plant survey, which is a valuable part of the service rendered by Tuffy distributors, a better idea came up. Why not make a rigging of Tuffy Slings ... handle all three sections of a tank at the same time... free the crane for other work? That's exactly what is happening in the picture above. Result: easier handling, ⅔ less crane time, big production-dollar savings. Further result, in the words of a company official:

"This was the first time this plant used Tuffy Slings. Now they have standardized on them."

Tuffy Slings are ideal for this job (and countless others) because of their superb combination of super-strength and free-flowing flexibility. It's just about impossible to kink a Tuffy Sling; and if you should, the kinks smooth out with no damage done.

Another Tuffy plus feature: Tuffy's pressed-on ferrule is applied over tuck splices under tremendous pressure to give the sling eye 100% of fabric strength.

Your Tuffy Distributor: a Good Man to Know

He's stocked to meet your needs; ready to make fast delivery of your Tuffy Slings, Tuffy Hoist Lines (famous working partners of Tuffy Slings), and Union Wire Rope. And he's qualified to help you find money-saving ways of using Tuffy products in your operation. Get in touch with him.

FREE! Tuffy Sling Handbook

Gives full data on Tuffy Sling types, uses, dimensions, weights and rated loads. Plus a complete rigger's manual and engineer's handbook on wire rope constructions and specifications. Write for your copy now.

union Wire Rope corp.

Specialists in high carbon wire, wire rope, braided wire fabric, stress relieved wire and strand

2272 Manchester Avenue **Kansas City 26, Mo.**

For more facts circle 556 on Reply Card

How Standard Oil finds new solution to machinery maintenance problems

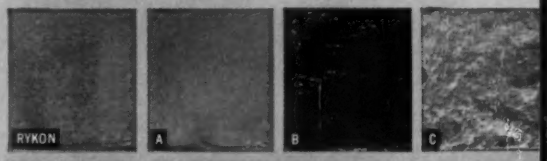
Grease with unique properties result of five-year research project

In oven test, grease samples on metal strips were baked in oven at 350° F. for five days. Only RYKON *Grease remained workable.*

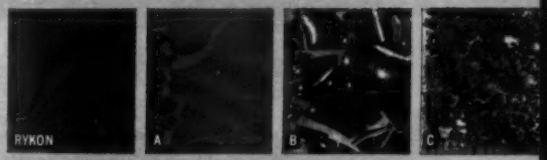
FIVE YEARS AGO Standard Oil launched a research project to develop a grease with properties not possessed by any other lubricant. This research resulted in a new line of greases to which Standard Oil has given the name RYKON. RYKON Greases have undergone severe laboratory and field testing. In these tests the greases demonstrated a remarkable ability to continue to provide lubrication after other greases failed. The greases show unusual mechanical, oxidation, high temperature and low temperature stability. They show exceptional resistance to water washout, to oil separation and to change in consistency. They have superior rust preventive properties.

RYKON Greases are true multipurpose greases. In some cases they can take over all lubrication jobs in a plant. The chance of lubrication failure due to the wrong grease being used may thus be eliminated. Grease inventory and inventory costs are reduced. Training of maintenance personnel is simplified. Supervisory follow-up is reduced or ended.

Further information about RYKON Greases will be sent to your plant management and maintenance men upon request. Just call your local Standard Oil office in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 So. Michigan Avenue, Chicago 80, Ill.



BEFORE. Samples of greases prepared for baking test.



After test, RYKON stayed grease-like. Other greases dried, turned asphaltic.

STANDARD

STANDARD OIL COMPANY
(Indiana)

For more facts circle 557 on Reply Card

How to get more storage space with BLAW-KNOX Electroforged® Steel Grating

You can get additional badly needed storage space easily and economically in your present building simply by installing platforms of Blaw-Knox Grating. It fits easily, neatly around pipes, beams and machinery without any alterations to your building.

Maintenance costs are slashed into the bargain. There's nothing to wear, nothing to patch. Blaw-Knox grating is self cleaning too. No sharp corners to clog up with dirt, and you'll find painting is easy since all surfaces are easily accessible.

You get maximum open area for plenty of light and ventilation. What's more, its rigid one-piece construction means maximum structural strength and load bearing capacity.

Blaw-Knox Electroforged Grating for walkways, stair treads and floors is fabricated to your specifications to meet your own operating requirements. Complete data on all types is contained in Bulletin 2527. Write for your copy today.

BLAW-KNOX

BLAW-KNOX COMPANY

Blaw-Knox Equipment Division
Dept. H Pittsburgh 38, Pa.

For more facts circle 558 on Reply Card

"How G-E carbon brushes helped . . .

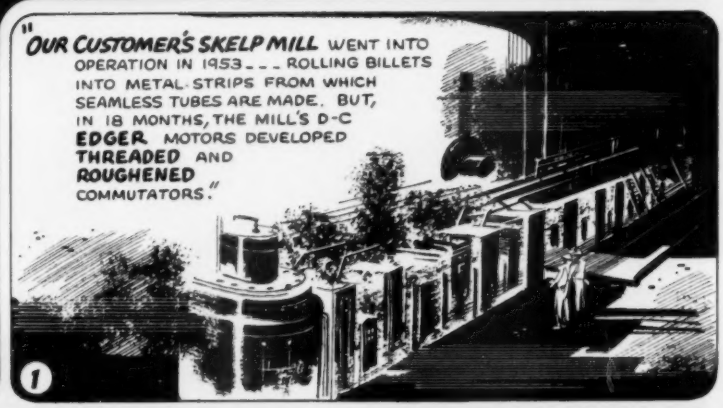
STOP METAL TRANSFER"

A GENERAL ELECTRIC CARBON BRUSH CASE HISTORY

AS TOLD BY

L. H. Schweitzer

CARBON PRODUCTS APPLICATION ENGINEER GENERAL ELECTRIC COMPANY

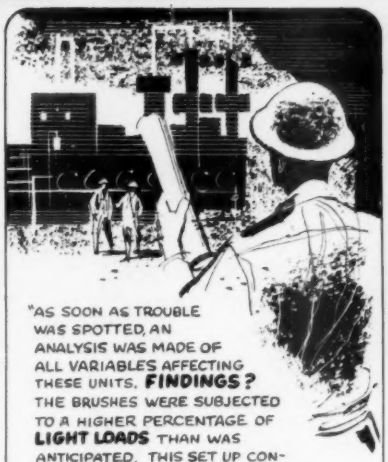


"OUR CUSTOMER'S SKELP MILL WENT INTO OPERATION IN 1953 . . . ROLLING BILLETS INTO METAL STRIPS FROM WHICH SEAMLESS TUBES ARE MADE. BUT, IN 18 MONTHS, THE MILL'S D-C **EDGER** MOTORS DEVELOPED **THREADED** AND **ROUGHENED** COMMUTATORS."

1

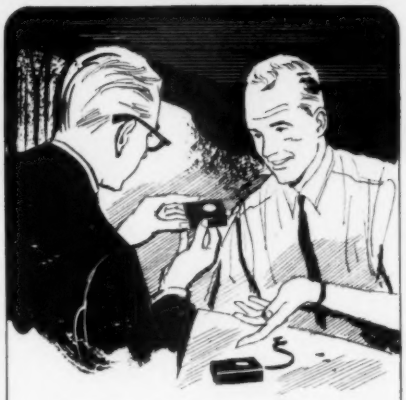
"SINCE THE EDGERS MAINTAIN STRIP WIDTH DURING ROLLING, CONTINUOUS PERFORMANCE WAS **IMPERATIVE**. WHEN THE MILL OPENED, A HIGH LEVEL OF MAINTENANCE WAS INITIATED BY THE CUSTOMER, AND OUR OWN ENGINEERS WERE CLOSELY FOLLOWING OPERATION OF OUR NEW ELECTRICAL EQUIPMENT."

2



"AS SOON AS TROUBLE WAS SPOTTED, AN ANALYSIS WAS MADE OF ALL VARIABLES AFFECTING THESE UNITS. **FINDINGS?** THE BRUSHES WERE SUBJECTED TO A HIGHER PERCENTAGE OF **LIGHT LOADS** THAN WAS ANTICIPATED. THIS SET UP CONDITIONS CONDUCIVE TO EXCESSIVE METAL TRANSFER AND POOR FORMATION OF A STABLE FILM ON THE COMMUTATOR."

3



"ABSENCE OF A PROTECTIVE FILM HASTENED THREADING AND ROUGHENING. SO A SPECIALLY DESIGNED GENERAL ELECTRIC BRUSH WAS RECOMMENDED, WHICH ENCOURAGED FORMATION OF A **STABLE FILM** UNDER THESE LOADS, THUS PREVENTING EXCESSIVE TRANSFER."

4

"**FAST FOLLOW-UP** AND A **COMPLETE LINE OF BRUSHES** FOR EVERY NEED SOLVED OUR CUSTOMER'S PROBLEM WITH **NO LOSS OF PRODUCTION!** CHECKS OVER THE NEXT TWO YEARS SHOWED THREADING AND ROUGHENING ELIMINATED."

5

SPECIFY GENERAL ELECTRIC CARBON BRUSHES FROM THIS COMPLETE LINE TO HELP GET TOP PERFORMANCE FROM **YOUR** G-E MOTORS AND GENERATORS. FOR HELP WITH YOUR BRUSH PROBLEMS USE COUPON OR CONTACT YOUR G-E APPARATUS SALES OFFICE OR DISTRIBUTOR. GENERAL ELECTRIC CO., SCHENECTADY 5, N.Y.

New bulletin offers answers to brush application and performance problems by one of industry's top authorities.

GENERAL ELECTRIC CO.
Section D774-5 • Schenectady 5, N.Y.

☐ Please send GEA-6688, "Better Carbon Brush Performance"

☐ Also, send GEA-5597, "G-E Carbon Brushes for Motors and Generators"

NAME.....

TITLE.....

COMPANY.....

ADDRESS.....

CITY..... STATE.....

GENERAL ELECTRIC

Put plant traffic on a safe road

with strong, easy-to-erect Armco Guardrail

Armco FLEX-BEAM Guardrail installed in a parking lot at Bendix Products Division, Mishawaka Plant, Mishawaka, Indiana. Note stall markings on the rail. No danger of wearing off and they are easy to see, even with snow on the ground.

Protects Machines and Equipment; Guides Traffic, Promotes Safety

You can use highway-tested Armco FLEX-BEAM® Guardrail to add safety and convenience to plant traffic. The cost is low.

FLEX-BEAM is a beam-type, deep corrugated steel rail (10 or 12 gage) that resists severe impact, yet flexes slightly to cushion the shock of a collision. You can attach it easily to almost any kind of post. Eight bolts join 12-foot sections. Maintenance is no problem. An occasional painting keeps FLEX-BEAM highly visible. The corrugated surface reflects light from any direction.

Put Armco FLEX-BEAM Guardrail to work inside and outside *your* plant at key points like plant entrances, parking lots, aisleways, structural supports for your buildings, and around valuable machinery and equipment. Write us for complete information about Armco FLEX-BEAM Guardrail. Armco Drainage & Metal Products, Inc., 3128 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

Wandering trucks cannot damage this important production equipment. FLEX-BEAM provides complete protection. Guardrail also makes definite separation of work area and busy traffic aisle.

Armco FLEX-BEAM Guardrail

ARMCO®

For more facts circle 560 on Reply Card

87 OF AMERICA'S "FIRST HUNDRED" CORPORATIONS
ARE WHITING CUSTOMERS
metalworking
Metalworking companies increase plant capacity... lower costs with these
WHITING PRODUCTS
Trambeam Overhead Systems, as shown above, handle materials and components in production . . . move finished products to storage or shipping. More profitable use of floor space is assured when goods move overhead on Trambeam. For fast point-to-point transport or complete area coverage, Trambeam is engineered specifically to your operation.
11

Here's how to "clear the decks" for efficiency and profits

See how Whiting Trambeam Systems handle materials and components overhead to keep floors and aisles clear for more efficient production . . . move finished products to storage or shipping. This new, 32-page, pocket-size booklet shows the advantages of Trambeam's point-to-point transport or complete area coverage. Tells how Trambeam can be custom-engineered to your exact requirements.

There's other helpful information here, too . . . on Whiting Cranes . . . on Trackmobile, the "Road-to-Rail Convertible" that speeds handling of freight cars . . . on every Whiting product used in your type of industry. Write today for a copy of "Working for Profit". *Whiting Corporation, 15675 Lathrop Avenue, Harvey, Illinois.*

WHITING

TRAMBEAM

MANUFACTURERS OF CRANES; TRAMBEAM HANDLING SYSTEMS; TRACKMOBILES; FOUNDRY, RAILROAD AND CHEMICAL PROCESSING EQUIPMENT

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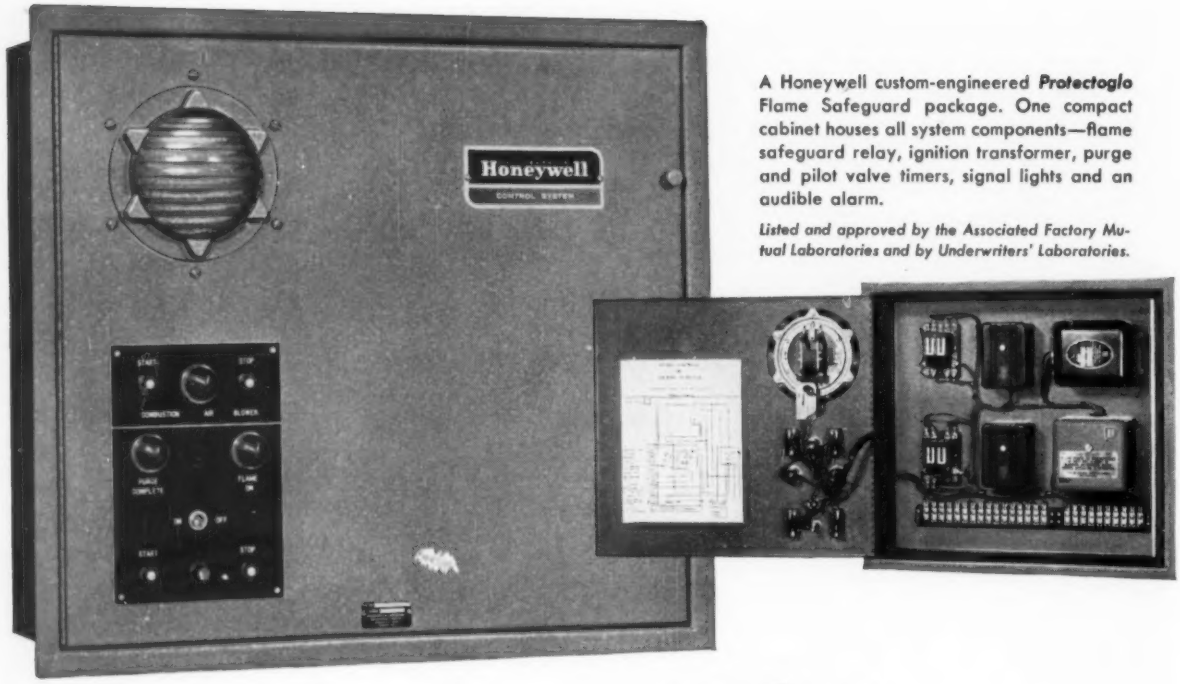
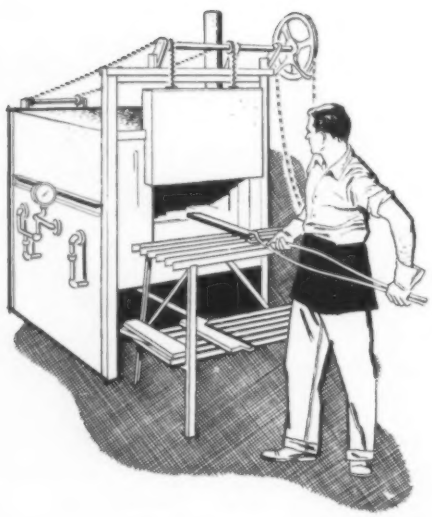


A Honeywell custom-engineered ***Protectoglo*** Flame Safeguard package. One compact cabinet houses all system components—flame safeguard relay, ignition transformer, purge and pilot valve timers, signal lights and an audible alarm.

Listed and approved by the Associated Factory Mutual Laboratories and by Underwriters' Laboratories.

Protection against...

- ***Production loss***
- ***Property damage***
- ***Personal injuries***



Here's fast, sure flame failure protection for any plant. But more than protection, Honeywell flame safeguard systems offer the convenience of automatic light-off and programming for automatic operation of dryers, ovens, furnaces . . . *all* fuel burning equipment.

Flame safeguards prevent the continued flow of unignited fuel into combustion space in event of flame failure or failure of ignition. And they prevent starting the burner before purging has been completed.

Programming variations include: cutoff or relight service; automatic, manual or standing pilot ignition; pre-purge; post purge; immediate or delayed valve opening.

Honeywell flame safeguard systems are designed for oil, gas or dual fired equipment . . . simple or complex . . . single or multiple-burners. We'll help with planning and startup.

Call your nearby Honeywell field engineer for details. He's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

H HONEYWELL *First in Controls*

COURT DECISIONS —a summary of legal findings of interest to the plant engineer

Prepared by Albert Woodruff Gray

Sales Tax Refund

WHEN PATTERNS were not furnished to a foundry by the customer with an order for castings, prices for the patterns were quoted to the buyer. That price approved, castings were made and both patterns and castings were delivered to the customer except in instances when the patterns were retained by the foundry for subsequent orders.

The Comptroller of the State of Maryland imposed a sales tax on the foundry in the purchase of these patterns on the ground that they were not purchased for resale but used in the production of the castings.

Under the laws of that state such a tax is imposed on all sales of personal property for any purpose except for resale. Here, the court held that, "In the purchase of these patterns, the sale was one exempt from tax under this law as it was a sale for a purpose other than those in which the purpose of the purchaser is to resell the property." Court brief 127 Atl. 2d 368, Maryland.

For Sale or Return

TEXTILE MACHINERY was delivered to a Vermont buyer. In the agreement the manufacturer undertook to install the machinery and put it in running order "to the satisfaction" of the purchaser. Before the machinery was set up, however, the purchaser died.

When the seller sought to recover possession of the machinery, representatives of the deceased buyer contended that they were entitled to the possession of the machine under this contract, claiming that the sale was one for "sale or return," that under the agreement title had vested in the buyer subject to his return of the machine and a cancellation of the sale if the machine was not satisfactory.

This conclusion, the court refused to adopt. The contract was not for a sale or return, it held, but a contract to purchase if the buyer was satisfied, that is, a sale on approval.

"The rule," said the court, "is that when by the agreement the seller is to do anything to the goods for the purpose of putting them into a condition in which the buyer is obligated to purchase them, or into a deliverable state, the performance of such conditions are a condition precedent to the vesting of ownership in the buyer." Court brief 51 Atl. 2, Vermont.

Purchaser Waives Damages

PROVISION WAS contained in a contract for the purchase and installation of a 7½-hp condensing unit in an ice cream plant in Kentucky, "If within 30 days after date of installation of the condensing unit to the present coils in your hardening rooms, the unit should prove unsatisfactory or if the equipment should fail to meet your refrigerating requirements as qualified above, the company agrees to remove this equipment and refund all moneys paid to it by you."

When the equipment proved unsatisfactory, a notice was given to the seller. The equipment was removed and the money refunded as stipulated. Later when the purchaser sought to recover damages for what it claimed was negligence in this removal in a suit against the seller, the court in a denial of any recovery, said that this stipulation on the back of the contract in which the manufacturer agreed to remove this equipment and refund the moneys paid it by the purchaser, was an exclusive remedy.

The manufacturer had followed that remedy, said the court, disconnected and removed its unit and returned the money paid. "The contractual rescission having been executed by mutual consent, terminated the rights of the parties under their restricted written contract." Court brief 100 S.W. 2d 819, Kentucky.

Buyer's Carelessness

WHEN A PURCHASER in North Dakota was sued on an agreement he had signed for the purchase of machinery, he set up as his defense that he had not read the agreement on account of lack of time and further, that its provisions were contrary to public policy.

This instrument, he insisted, had been drawn with the intent to deceive, its provisions were in fine print, his attention had not been called to them and he had signed it without knowledge of its contents and in the belief that it embodied the representations and warranties made orally to him by the agent of the seller prior to the time the order was signed and that the contract so drawn and so used was invalid and void as being unfair, fraudulent and contrary to public policy.

In its order that judgment be entered in favor of the seller, the North Dakota Supreme Court said, "Nothing was done on the part of the salesman to prevent him from reading the instrument. The circumstances existing at the time he signed it were of his own creation. Neither do we think there is any merit in the contention that the contract was void and unenforceable because it was unfair, unreasonable and contrary to public policy.

"There is nothing inherently vicious about the terms set forth in the contract. One party was selling a machine. The other was buying one. Certainly, a proper and legitimate business transaction. The parties were dealing at arm's length." Court brief 209 N.W. 996, North Dakota.

Refusal to Warrant

SUIT WAS brought in the state of Washington for the purchase price of a machine. In the contract it was provided, "The purchaser hereby acknowledges that all the terms and provisions of the purchaser's agreement with the seller are contained in this contract; that there is no other agreement collateral hereto and that the seller has made no representations or expressed or implied warranty with respect to said property which is not set forth in this agreement."

The purchaser claimed the seller had failed to fulfill an expressed warranty of the qualities of the ma-

COURT DECISIONS

chine. The court denied the purchaser any recovery. Both purchaser and seller had by the terms of this agreement limited the seller's liability.

The court stated, "This court has held on numerous occasions that when a seller and a buyer enter into a contract in which the seller expressly refuses to give any warranty and that contract is not induced by fraud, no warranty of any kind can be implied by law." Court brief 301 Pac. 2d 1082, Washington.

Shop Rights

PROCESS FOR THE manufacture of composite metal molds for electrotyping was discovered and patented by an employee of an engraving and electrotyping plant in Ohio.

Under an oral agreement, the employer had promised the inventor a royalty of 10 per cent in return for an assignment of the patent. For two years these royalties had been paid. Then, when the employer refused to make further payments, suit was brought by the inventor to collect.

In its defense, the employer maintained that the invention had been planned and perfected while the inventor was acting as superintendent of the electrotype plant, that he had been paid for his time and work and was not entitled to further royalties. It was further contended, by the employer, that under the circumstances it had a shop right in this invention by which it had a right to its use.

In denying the employer that right by virtue of the assignment of the invention, the court said,

"An employee not under contract with his employer to invent, may protect himself against the establishment or accrual of a shop right in his employer in any invention or device perfected by such employee on his own time and at his own expense, though during the period of his employment, by words, acts or conduct, which denies the establishment of such a right.

"It is likewise true," said the court in this instance, "that if the employer and employee by contract enter into arrangements whereby the employer agrees to compensate the employee, then such agreement determines the relationship of the parties in regard to the invention since it is entirely within the right of the employer to contract away this shop right which would occur if no agreement were made." Court brief 100 N.E. 2d 310, Ohio.

Labor Dispute Arbitration

IN A COLLECTIVE bargaining agreement, it was stipulated "all disputes, differences or grievances arising out of the interpretation of the application of the provisions of this agreement," should be presented for arbitration.

It was further provided that salaries should be increased "on a merit basis only" and that such merit increases should be at the sole discretion of the employer.

After this bargaining agreement had been made, the employer, upon opening a plant in Utah, offered some of these employees transfers to that location and those who accepted the offer were given salary increases. This, the union contended, was not a salary increase awarded on a merit basis only and asked that the controversy be submitted for determination to arbitration.

In granting the application of the union for arbitration, the Federal court said, of the Norris-LaGuardia Act which provides that no Federal court shall issue an injunction in a case growing out of a labor dispute.

"The general structure, detailed provisions and legislative history, of that statute show it has no application to cases where a mandatory injunction is sought to enforce a contract obligation to submit a controversy to arbitration under an agreement voluntarily made."

On that ground among others, the court concluded that while not all "grievable" disputes are arbitrable under this contract, this one is as it involves a difference in the interpretation of the provisions of the agreement authorizing wage increases on a merit basis only. Court brief 148, F.S. 521, February 5, 1957.

Confidential Disclosures

SUIT BY THE owner of a patent of a rotary drill was brought against a refining company for what this patent owner claimed was a violation of a confidential relation and disclosure.

After his patent had been granted, this patentee had called on a representative of this oil company in an effort to secure the cooperation and financial help he needed in the marketing of this bit. The information he disclosed in this interview was merely the contents of his patent application, a wooden model and machine drawings. Subsequently some of these bits, which had been sold by the patentee to the oil company, completely disclosed the construction of the patented article.

The court added, "No cause of action for a breach of confidence could accrue to the owner of this patent when he revealed the subject matter of the invention to another, by reason of the use or publication by the other after the issuance of the patent, as the issuance of the patent was a publication of the information to the world."

"In this case," concluded the court, "all of the acts on the part of the oil company of which this patentee complains, occurred after he sold to the public the bits incorporating his alleged trade secret." Court brief 150 F.S. 143, Sept. 28, 1956.

Waiver of Damages

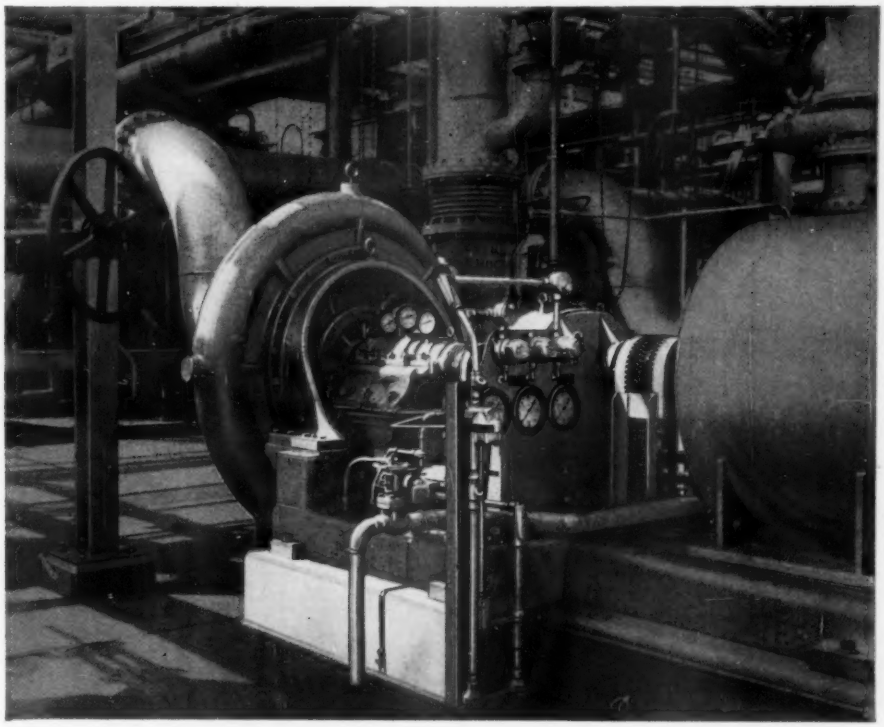
PROVISIONS IN THE contract for the cementing of a Kansas oil well was that the company "shall not be responsible or liable for any loss, damage or injury to said well resulting from the use of such cementing equipment or for the acts of any person in doing such work on the above described well."

When suit was brought for damages by the well owners, this stipulation in the contract was set up as a defense. Of its effect, the court said, "This provision of the contract relieving the owner of the equipment of liability for loss or injury to the well, was valid and effective both under the law of Kansas and the law generally applicable.

"The fact that the cementing of the well brought unfortunate results," commented the court, "could not, even if true, release the owners from the obligation to pay.

"There is no public policy," said the court in conclusion, "which forbids parties as between themselves, from contracting against liability." Court brief 238 Fed. 2d 957, December 18, 1956.

FOR TIDEWATER OIL COMPANY'S GREAT NEW REFINERY



Process Design
—Ralph M. Parsons Co.

Constructors
—C. F. Braun & Co.

R-C
Centrifugal Equipment
purchased for
this installation

Three single-stage centrifugal blowers, two turbine driven and one motor driven. Each blower is rated at 11,500 cfm at 4.8 psig operating at 5100 RPM requiring approx. 320 HP

R-C Centrifugal Blowers Supply Combustion Air for Sulfur Plant

For the industry's largest sulfur-recovery plant at Tidewater's "refinery of the future" at Delaware City, Roots-Connersville centrifugal blowers supply combustion air for processing hydrogen sulfide from sour crudes to elemental sulfur.

One of the basic design requirements for this plant is extreme flexibility. When the refinery is operating on high-sulfur crudes, sulfur production may reach 340 long tons per day. With low-sulfur crudes, production may be less than one-fifth this amount.

To satisfy these widely varying requirements, Roots-Connersville centrifugal blowers assure positive control of air delivered to the reaction furnaces. Whatever the conditions may be, they provide the kind of dependability that results in continuous, efficient operation for long periods of time. Whatever the service, you can count on this dependability in Roots-Connersville centrifugal equipment in capacities from 1,100 to over 100,000 cfm.

For additional data, please refer to our section in **Chemical Engineering Catalog** or **Mechanical Catalog** or write for Bulletin 120-B-14.

ROOTS-CONNERSVILLE BLOWER
A DIVISION OF DRESSER INDUSTRIES, INC.
158 Power Avenue, Connersville, Indiana. In Canada—629 Adelaide St., W., Toronto, Ont.

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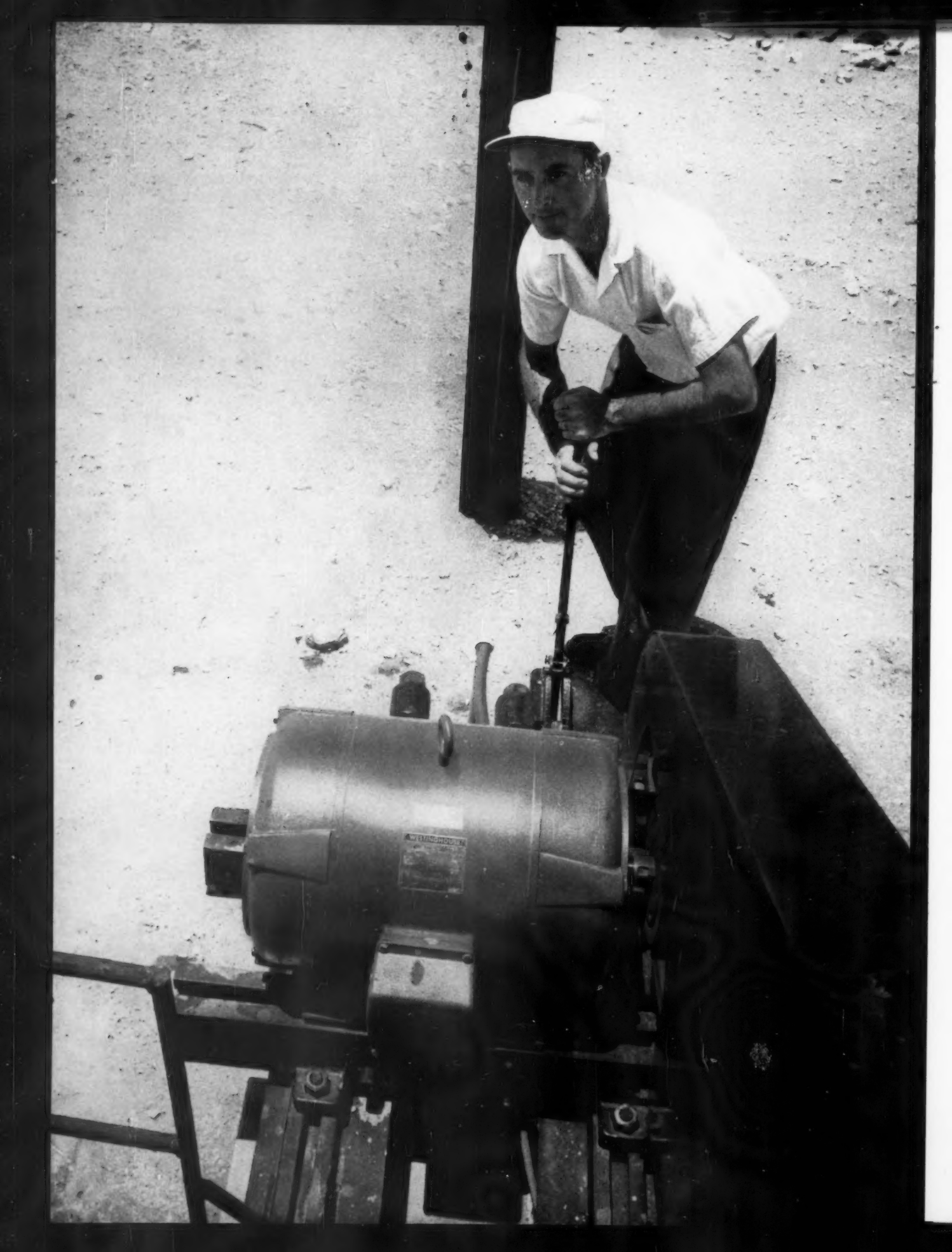

Sand . . . heavy rain . . . extreme heat . . .

Nothing stops These Westinghouse Life-Line A Motors

dependably driving oil well pumps in Odessa, Texas district of The Atlantic Refining Company, 24 hours per day, 7 days a week!

"Here's an application," says A. P. Johnston, production engineer at The Atlantic Refining Company, "where we must have continuous motor operation . . . sometimes for as long as 18 months . . . with virtually no maintenance or repair. Many of our pumping stations are remotely located, automatic and unmanned. Any stoppage or motor failure would result in the loss of several hundred barrels of oil. Motor repairs in the field are prohibitive in cost. We must have *complete* motor reliability and that's exactly what we get from our Westinghouse Life-Line® "A" motors."

How about you? Got a really tough motor application which you can't afford to pamper? Then ask your Westinghouse sales engineer to show you how the dependable Life-Line "A" pays for itself through reduced maintenance and repair. Or write to Westinghouse Electric Corp., P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania. J-22055

YOU CAN BE SURE... IF IT'S Westinghouse

On this pumping unit, the 15-hp Life-Line "A" motor operates in an atmosphere of damaging dust, sand and moisture. Despite continuous, heavy-duty service, motor has never suffered any overheating since first installed. Prelubricated bearings of the Life-Line "A" eliminate periodic greasing . . . keep lubricant in . . . dirt out.

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Here's a system that spells safety—nothing to trip over, no congestion—no heavy handling.

Trucks containing motor sub-assemblies, move freely and constantly from work tables to the next process.

Special "Y" type device at top of truck mast automatically engages with the trolley rod moving on the Landahl Chainless Conveyor. Manual release at discharge station releases the truck. Let an experienced Landahl engineer help with your conveyor problems. Write for Bulletin LS-2.

LANDAHL CONVEYOR DIVISION

AMERICAN MONORAIL

ENGINEERED MATERIALS HANDLING

OVERHEAD HANDLING EQUIPMENT

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CLEVELAND 7, OHIO

MEMBER OF MATERIALS HANDLING INSTITUTE AND MONORAIL MANUFACTURERS ASSOCIATION

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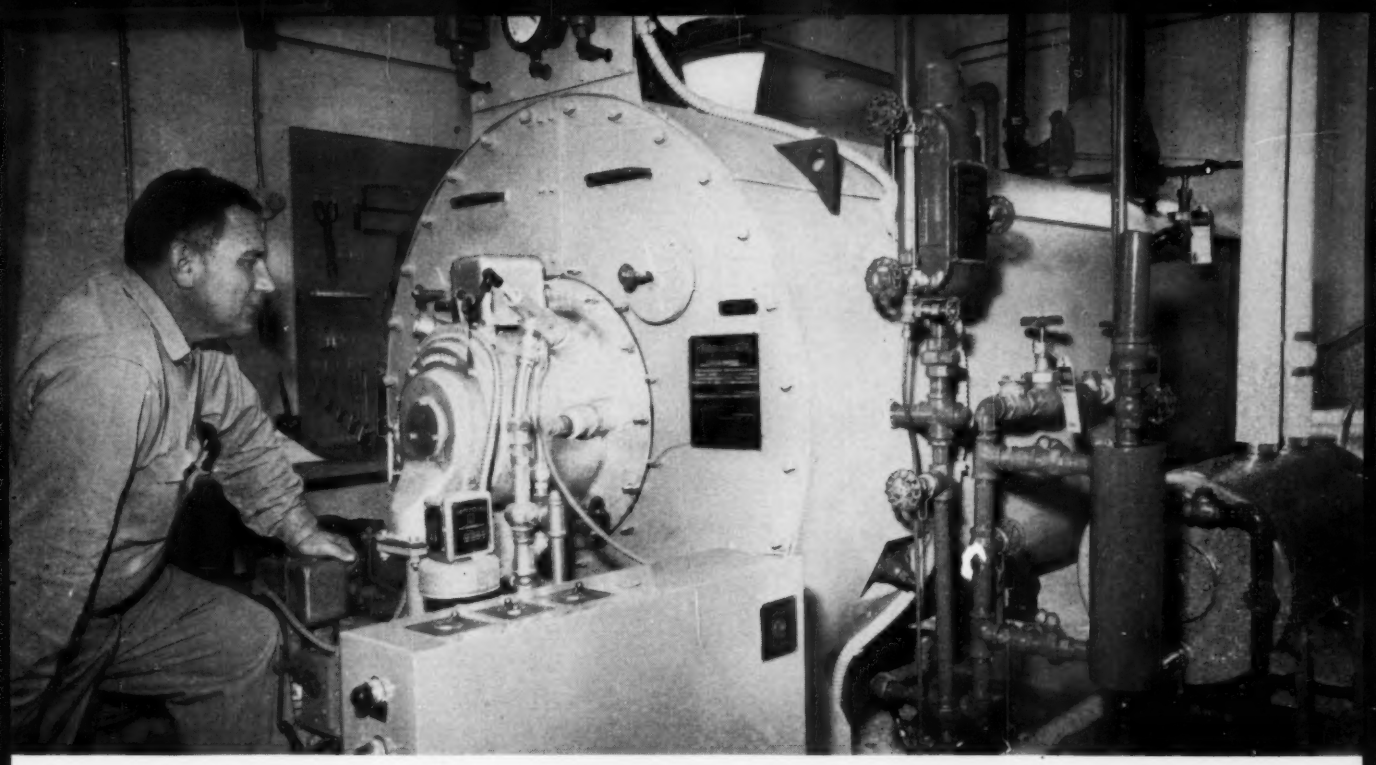
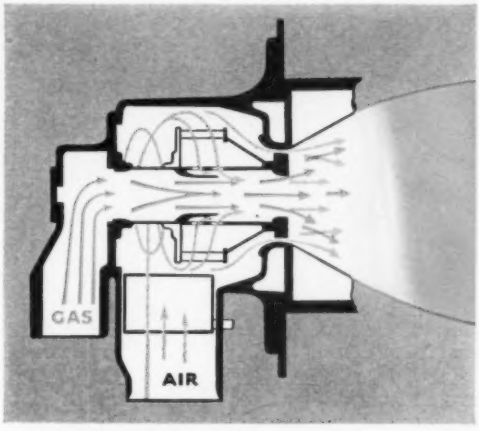


Why this boiler room would pass the "WHITE GLOVE" test



O&S Gas Burner keeps fuel costs DOWN, boiler efficiency UP

Designed and built by O&S expressly for *Powermaster*, this pre-mix gas burner assures complete, clean combustion over full firing range. Its simple, sturdy construction minimizes maintenance.

Here's the attractive kitchen-clean boiler room of a food extracts manufacturer in Nyack, New York. This gas-fired *Powermaster* Packaged Automatic Boiler makes possible the cleanliness so important to a food products industry such as this. It replaced an oil-fired vertical tubular boiler when the company decided to convert to cheaper gas fuel.

Under widely fluctuating steam demands for cooking kettles, distillation, plant and office heating, the *Powermaster* maintains constant pressure at all loads.

Operating continuously, this completely factory-assembled and fire-tested unit is proving the wisdom of the modernization by its economy, dependability and time-saving automatic operation.

Here's what the Plant Engineer says about the boiler: "I think the *Powermaster* boiler is one of the finest package units available. We like the unit because of simplicity of operation, constant trouble-free steam load provided, the protective and safety devices incorporated in the unit, and the exceptionally good wiring job on the unit.

"I highly recommend the *Powermaster* boiler to other manufacturers." Write today for bulletin.

Powermaster®

PACKAGED AUTOMATIC BOILERS

Builders of Dependable Boilers Since 1885

ORR & SEMBOWER, INC.

Morgantown Road, Reading, Pa.

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IT THINKS with a difference that means extra protection!

ECON-ALLOY makes the Difference!
When current overload is continued beyond the safe and pre-determined time, exclusive Econ-Alloy breaks the circuit by changing directly from solid to liquid. The usual plastic stage is eliminated, insuring faster, more accurate protection against overloads and shorts.
Cut Fuse Costs
End Needless Fuse Blows
Eliminate Down Time
* Fast Short Circuit Protection

ECON®
DUAL-ELEMENT cartridge fuses

With the exclusive, *different* Econ-Alloy thermo element acting as the "brain" of the ECON Dual-Element Fuse, you get *double* protection: accurate, "timed" protection against overloads (up to 500%)—and *instant* breaking action on shorts.

Economy Dual-Element Fuses are specially engineered for motor, branch and feeder circuits—save time and money where you have frequent power surges, or the risk of high fluctuation in load.

Available in knife and ferrule types: 0 to 600 amperes; 250 and 600 volts. Approved by Underwriters' Laboratories, Inc.

Write for ECON Dual-Element Catalog S-60
. . . or literature on all Economy Fuses.

ECONOMY FUSES
FOR EVERY PURPOSE

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Order ECON Dual-Element and other Economy Fuses directly from your ELECTRICAL WHOLESALER

ECONOMY FUSE & MFG. CO., 2717 Greenview Avenue, Chicago 14, Illinois

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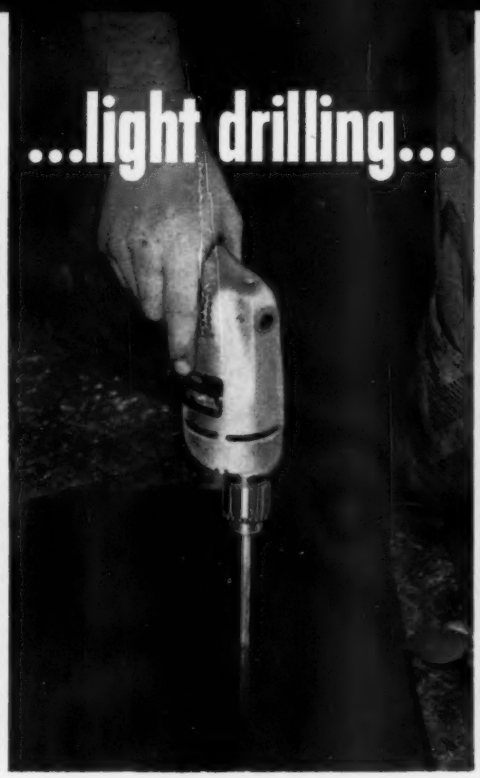
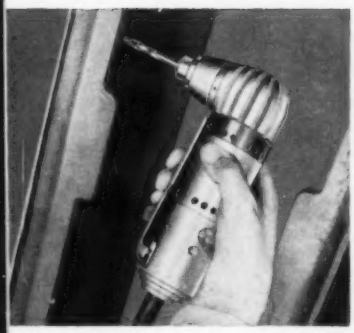
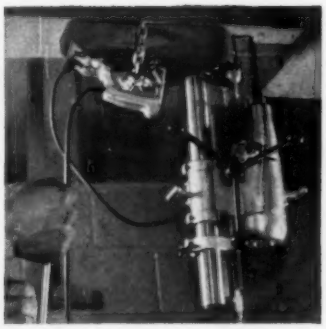


There's a Black & Decker Drill powered for every job!



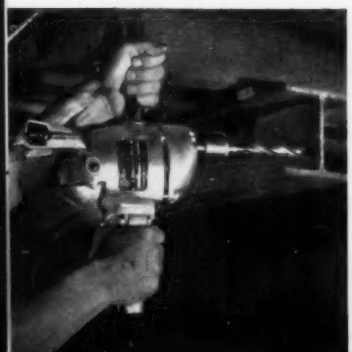
LITTLE SHORTY's the drill you want for those hard-to-get-to, around-corner jobs. Gets in tight spots! Excellent for small unit assembly.



DRILLS UPSIDE DOWN! B&D Magnetic Drill Press sticks to the wall like a fly; operates manually or with exclusive remote control.

TREMENDOUS TORQUE for the tough jobs. ⅜" Heavy-Duty Drill is geared and powered to take on the hard ones. Compact to work in close quarters.

MOST POWERFUL drill of its size available, the ¾" Standard! A rugged tool with plenty of zip in reserve. Fully reversible; positive drive clutch.



71% of purchasing agents say make mine Black & Decker!

A recent industrial publishing company survey reveals that when purchasing agents need electric tools most think first of Black & Decker! One reason why: 33 *different* drills each designed to give you the power you need *plus* easy handling and long, troublefree life!

If you have a drill problem, be sure to look to Black & Decker. See us at the *Plant Maintenance Show* or better yet, mail the coupon below for a free demonstration. THE BLACK & DECKER MFG. CO., Dept. 0801, Towson 4, Maryland (In Canada: P. O. Box 278, Brockville, Ontario).

Look Under "TOOLS-ELECTRIC" in Yellow Pages

Leading Distributors Everywhere Sell

Black & Decker®

Quality Electric Tools . . . Power-built for top performance

MAIL COUPON FOR FREE DEMONSTRATION

THE BLACK & DECKER MFG. CO., Dept. 0801, Towson 4, Md.

☐ Please arrange for a demonstration of the following drill(s) .....

☐ Please send me additional information.

Name..... Title .....

Company.....

Address.....

City..... Zone..... State.....

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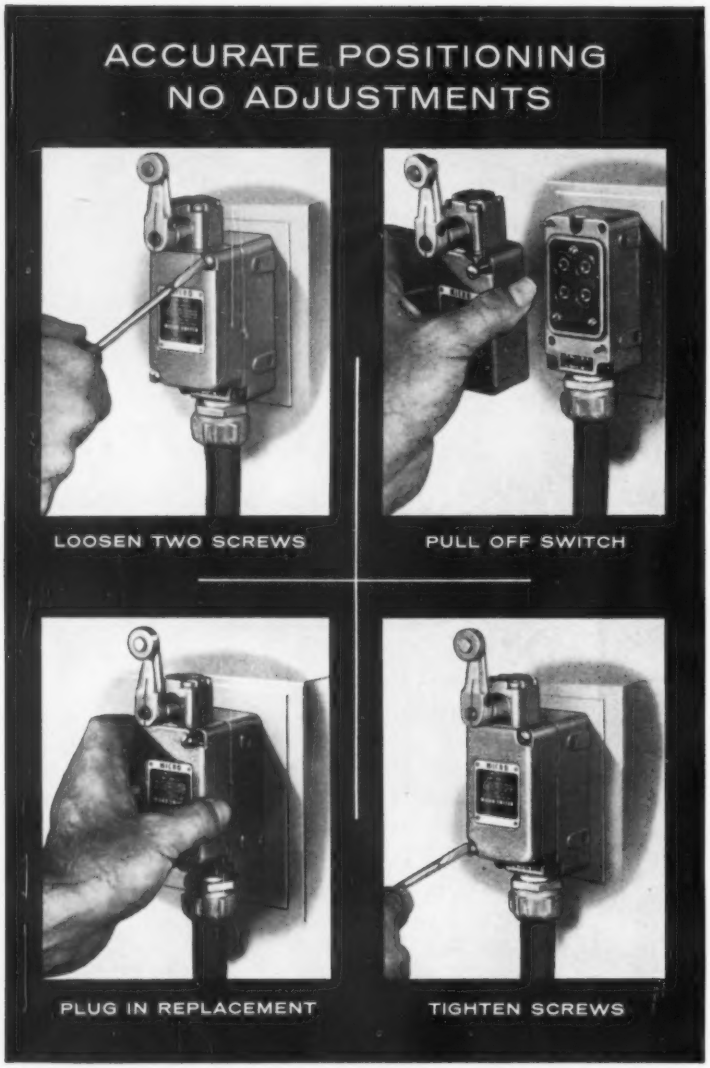
MICRO SWITCH Precision Switches

You can replace this precision switch in 20 seconds!

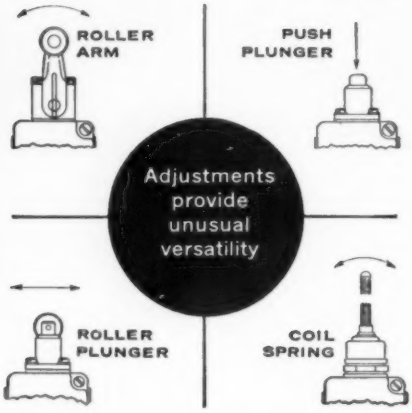


The new MICRO SWITCH "Plug-in Limit" saves many precious minutes of downtime on your high-speed automatic production lines. It plugs in like a radio tube—can be replaced in a fraction of the time required for ordinary limit switches.

This sensational new type "LS" switch offers all the features of rugged construction and precise, long-life operation as the industry-proved "1LS1" switch.

Wiring connections are made to a sealed terminal block enclosure which is permanently mounted to the machine. The switch enclosure, including all moving and mechanical parts, is plugged on to this block and precisely positioned by means of dowel pins.

Actuators available to meet all requirements



MICRO SWITCH "Plug-in Limit" switches are available at authorized distributors in key cities everywhere. Look in the Yellow Pages under "Switches, Electric." Send for Bulletin No. 20.

MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS

First in Precision Switching

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42 USS PERM-A-TRAK industrial turnouts

installed to handle heavy intra-plant traffic

THIS USS PERM-A-TRAK industrial turnout was one of forty-two recently installed at the Warrick Works of the Aluminum Company of America in southern Indiana. The contractor was W. H. Nichols & Co. Inc., of Dallas, Texas. Rugged USS PERM-A-TRAK was recommended by United States Steel for use in the power plant area. Here, trains of heavy coal-laden cars are frequently moved to supply the generating station boilers with fuel.

USS PERM-A-TRAK is a heavy-duty turnout capable of sustaining a consistent stream of rail traffic in industrial plant areas. Its inherent strength assures long life with little maintenance. What's more, the initial cost of these turnouts is relatively low.

USS PERM-A-TRAK is the heaviest of three packaged units offered for industrial use. Two other units, USS ECON-A-TRAK and USS DUR-A-TRAK, have been assembled to provide a choice of different turnout constructions for varying load-carrying requirements. The proper turnout, whether it be lightweight construction or a much heavier type, can be obtained on a quick delivery basis for any weight of rail or speed of industrial railroad traffic.

The extra care and effort that go into the manufacture of switches, frogs, and special track layouts make USS Trackwork the finest you can buy. Specify USS Industrial Trackwork for all your requirements. Free copies of the booklet "USS Industrial Turnouts" are available upon request, or, if you like, we will have a trackwork engineer call on you. Write or call our nearest District Sales Office or United States Steel Corporation, 525 William Penn Place, Room 2801, Pittsburgh 30, Pa.

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USS TRACKWORK

UNITED STATES STEEL

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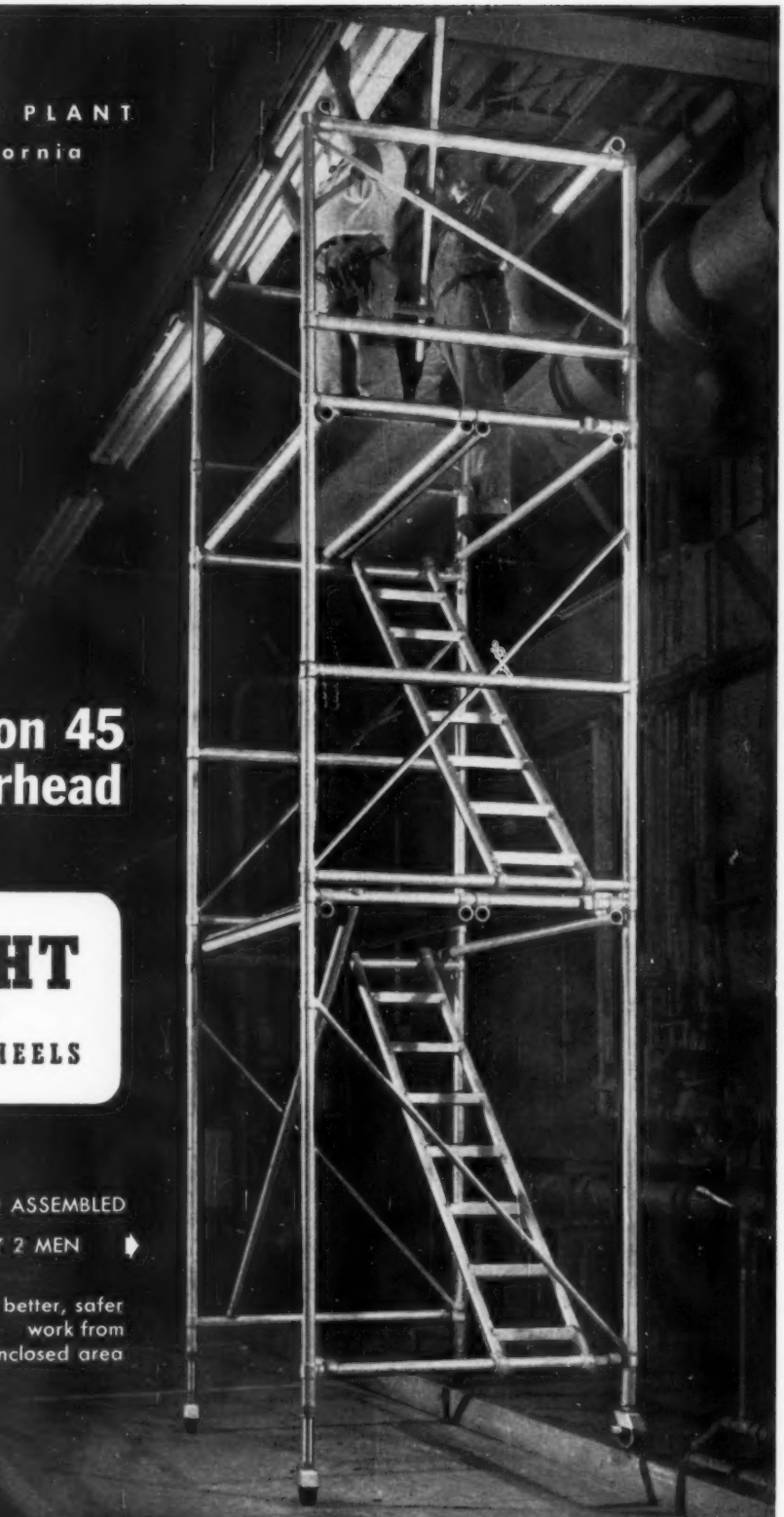
FORD ASSEMBLY PLANT
San Jose, California



Plant saves on 45 acres of overhead work with

UP-RIGHT
aluminum
SCAFFOLD-ON-WHEELS

17 FT. SCAFFOLD ASSEMBLED IN 2 MINUTES BY 2 MEN

Faster, better, safer work from large enclosed area

WRITE FOR CIRCULAR

You, too, can save with these rapidly assembled Up-Right aluminum scaffolds

Up-Right Scaffolds • Dept. 163 • 1013 Pardee St., Berkeley, Calif.

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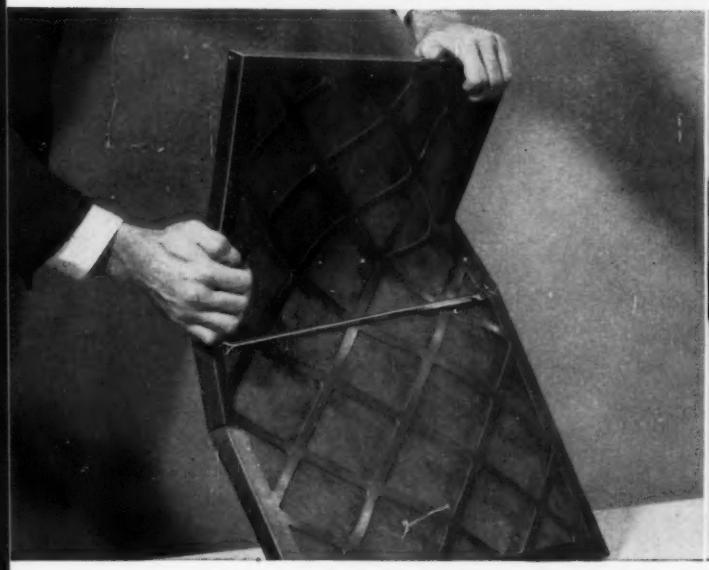
PROVE IT TO YOURSELF

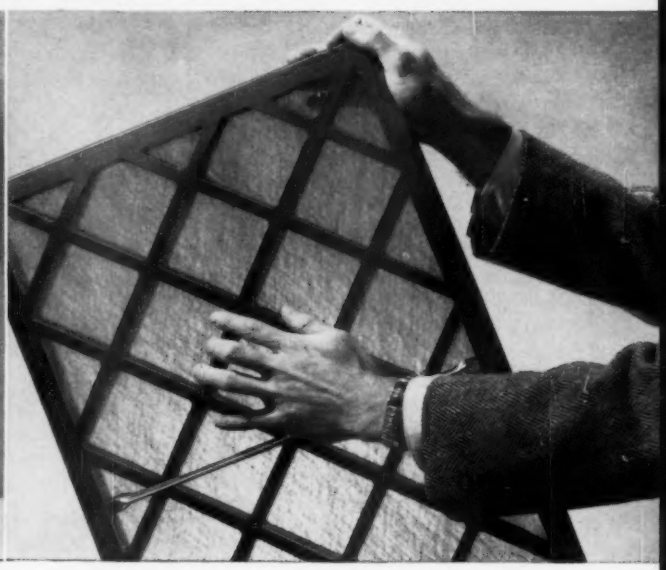
...how much stronger...how much safer

Glasfloss® fiber glass Safety-Grille* filters really are

*TRADE MARK

MAKE THESE TESTS...





1. Bend it—and the new Glasfloss Safety-Grille Filter bounces right back to its original shape. Old type metal-grille filters don't. Unless you re-bend them, they stay bent out of shape and can cut down filtering efficiency. Strong construction of Glasfloss Safety-Grille Filters means less chance of damage in transit, in storage, in handling.

2. Feel the grille edge—it's chipboard, and perfectly safe! No sharp edges—no cuts, no scratches to worry about!

For maintenance personnel, the new Glasfloss Safety-Grille eliminates any danger of cut hands or wrists and possible infection when changing filters.

Plus these features... Glasfloss Safety-Grille Fiber Glass Filters . . .

—have same available filtering area and initial pressure drop as old-type filters
—are tested and proven in service
—are approved by Underwriters' Laboratories, Inc.

Make these tests: Try PPG's new Glasfloss Fiber Glass Safety-Grille Filters in your heating and air conditioning systems. Get top filtering results! They're available in a complete range of sizes from your local distributor or PPG Warehouse.

A Product of Pittsburgh Plate Glass Company

Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh and St. Louis

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For more facts circle 572 on Reply Card

(Advertisement)

TIPS ON TRUCKS

Compact, maneuverable . . . and electric

Tight quarters or congested areas need pose no special material handling problems. Not when you stop to consider the highly efficient, powerful package in compact space afforded by one of the many variations of electric trucks on the market today. Name your particular problem—and there is literally an electric truck *engineered* for the job.

Versatile, maneuverable, easy to inch and turn, electric trucks provide the smooth, even power required for stacking the most fragile cartons ceiling-high. And from the standpoints of fast operation, cleanliness, quiet, and low maintenance . . . electric trucks tell quite a powerful story.

Little wonder today that efficient, economical material handling is synonymous with electric trucks.

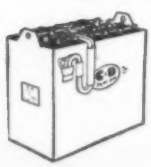
The battery's the thing

But even with an electric truck, you can't get more out than you put in. That's why it becomes so important today—considering all the power attachments—to pack as much possible power into the truck you can. Not just a battery . . . but a C & D extra-capacity *Slyver-Clad*® battery. Longer, heavier plates in the standard-sized tray assure you of plenty of power for the toughest jobs.

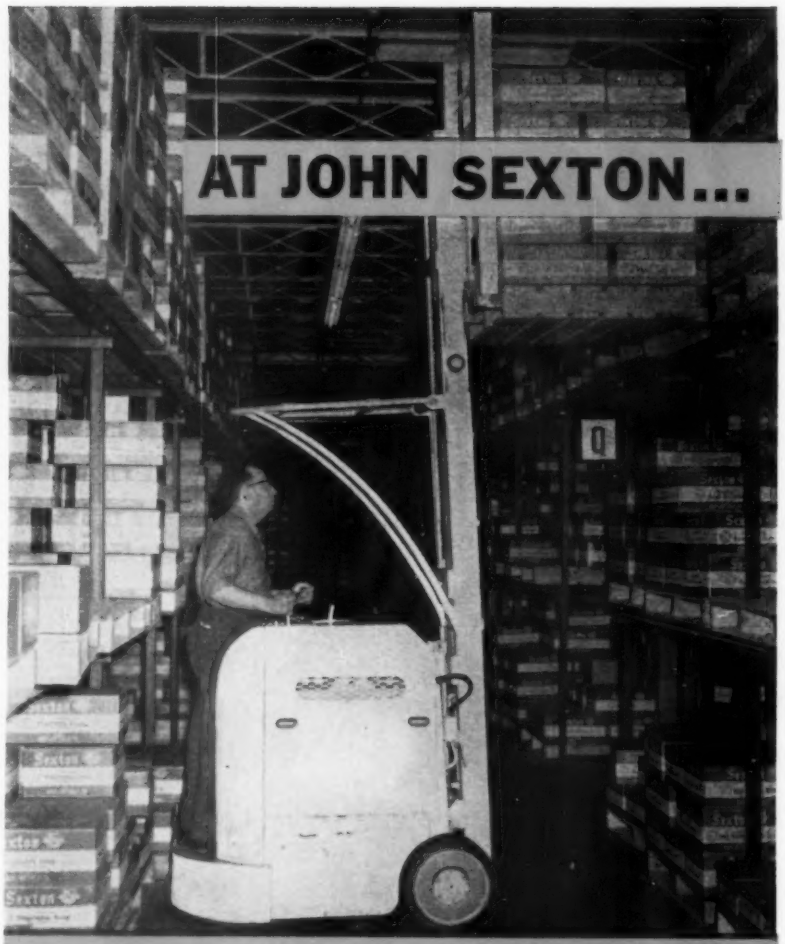
(Why not check on the C & D story of "more power for your electric trucks" through advanced design and industry-proved, exclusive Slyver-Clad construction. Just send for the literature offered in advertisement at right.)

A matchless combination

...the tops in trucks—electric



...and the tops in truck batteries—C & D



New food warehouse, John Sexton and Company, Chicago, Ill.

Speed warehousing; up efficiency; hold maintenance costs 'way down

Trucks electric . . . powered by C&D

John Sexton and Company, Chicago manufacturers and wholesalers of fine food products, squeezed extra storage capacity out of its new 175,000 square-foot warehouse by narrowing aisle width to a minimum.

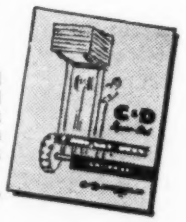
Compact electric fork-lift trucks—powered by C & D *Slyver-Clad*® batteries—maneuver deftly in the most congested areas. The battery-powered trucks speed operations, boost handling efficiency, and keep maintenance costs low. And thanks to C & D's extra battery capacity, there's power to spare, even when stacking large pallet loads of goods ceiling-high.

Another *matchless combination:* electric trucks . . . powered by high-capacity C & D *Slyver-Clad* batteries!

It pays to see why "C & D is a better battery buy"

See how C & D's advanced principles of design and extra battery capacity cut material handling costs . . . give your trucks a power boost.

Write for descriptive bulletins.



C&D BATTERIES, INC.

of Conshohocken, Pa. ... Attica, Ind.

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Sales and service offices in principal cities from coast to coas

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What's Just Ahead in This Issue?

FOR HELPFUL information on Industrial Lighting, turn to the special 12-page section beginning on page 135. With new equipment, higher voltages and other factors entering the lighting picture, you will want to have all the facts to assist you in the design of a lighting system in your plant. Here are the facts, based on the experiences of a Western Electric Company plant engineer, to guide your planning.

WOULD YOU like to know how your job—and your handling of that job—stacks up with that of your counterparts in 520 top-notch plants across the country? How many have maintenance cost measurement? How many have maintenance work measurement? Preventive maintenance programs? These and many other facts on operation of their plant engineering departments are given in the article "Profile: The American Plant Engineer." It starts on page 119.

SCORES OF years of experience of men well-known in the plant engineering field will be available to conferees at the 9th Plant Maintenance and Engineering Conference. Twenty-five sessions dealing with maintenance problems will be conducted, some in the form of talks, others in the form of round table discussions, but all where questions and answers may be freely exchanged. If you plan on attending the conference, look over the sessions listed on pages 96 to 101 and see which will help you most.

KNOWING plant engineers to be continually beset with problems, large and small, Plant Engineering's editors got curious about the "big one"—the problem that our readers feel is the major one today. So, we asked. One third of the respondents feel that their primary problem lies in the training of craftsmen in their work force. There are other problems, too, that plague the plant engineer today, as you will learn when you turn to page 112.

HAVE YOU ever been at a loss as to how to present a specific proposal on additional maintenance labor, increased expenditures, or what-have-you-that-costs-money to your top management? Listen to a man who has been through that same mill many times and find out how he proves, not only to top management but also to the entire plant including his own workers, the value of good maintenance. Read the article starting on page 106.

TRAINING programs at Esso Standard are providing men in the mechanical trades with additional job know-how. It also enables them, through advancement, to earn more money. As a result of this on-the-job training program, 16 first-class mechanics have already graduated from the course. There are 46 other mechanics taking part in their present program. Could you use such a program in your plant? Read the article on page 132.

ARE YOU planning to start a preventive maintenance program right from scratch? If so, you'll want to read the experiences of one outstanding plant engineer who had to do the same thing. He tells how he gathered material and advice and how he finally got the plan rolling. This article should be of interest even to those plant engineers who have an established, working program. The article starts on page 102.

"The maintenance conferences afford both information and inspiration for the maintenance executive who is seeking to do the best possible job."

L. C. Morrow
General Chairman

. . . and These Speakers Will Tell You How at the

9th Plant Maintenance and Engineering Conference Sessions

Interest in Maintenance Accelerates

Statement by L. C. Morrow, General Chairman, Plant Maintenance and Engineering Conference. "Interest in maintenance on the part of plant management continues to accelerate. More and more companies are carrying on searching investigations of their maintenance operations, looking toward discovering opportunities for cost reduction. And some of these companies are finding virtual gold mines. It is the rare company that cannot improve its maintenance. The extent to which it is successful will depend upon how well-informed its maintenance personnel are, and the extent to which they show real cooperation and initiative. The maintenance conferences afford both information and inspiration for the maintenance executive who is seeking to do the best possible job. New procedures, new methods, new experiences are reported at each conference, and this, the ninth, is no exception."

L. C. Morrow

T. L. Dempsey

R. M. Kolb

R. P. Witschen

L. G. Cannon

F. O'Leary

F. L. Bradley

Monday morning, January 27, 10:30 Amphitheatre

1. "How We Analyzed Our Maintenance Management."

Chairman: L. C. Morrow. Speaker: W. E. Chandler, Manager Maintenance Engineering Service, Organic Chemicals Div., Monsanto Chemical Co., St. Louis, Mo.

Discussion of the steps required to show management what a well-planned maintenance system, operated by a properly organized and administered maintenance personnel, can do to achieve low unit cost of production.

Monday evening, January 27, 7:30 (Concurrent) Palmer House

2. "Welding in Maintenance."

Chairman: Thomas L. Dempsey, General Manager, "Industry and Welding," Cleveland, Ohio. Speaker: Ray Kolb, Superintendent, Welding Dept., Standard Oil Co. of Indiana, Whiting, Indiana.

Mr. Dempsey: Definitions and comparisons of arc, gas, inert, thermit hard surfacing and burning will be given, also types and applications of electrodes, welding and cutting stainless steel, alloys, and non-ferrous metals. Motor generator sets versus rectifiers will be discussed especially with regard to versatility, life inspection, and upkeep and duty cycle.

Mr. Kolb: An outline of an approach to diversified and difficult welding problems will be this speaker's subject. Acetylene and electric arc welding will be compared with the newer processes such as submerged arc welding and inert gas welding. Electrode and filler metal selection; applications to maintenance of metallizing and hard surfacing; and procedure and operator qualification will also be discussed.

3. "How To Save on Electric Power Bills."

Chairman: Robert P. Witschen, Plant Engineer, General Products Div., Owens-Corning Fiberglas Corp., Barrington, N. J. Speaker: L. G. Cannon, Manager of Power Service, Commonwealth Edison Co., Chicago, Illinois.

Mr. Cannon: The whys and wherefores for industrial power rates, how to select the best rate and how to make the rate produce the lowest possible power cost, will be presented. Methods for improving load factor and power factor and for making electric service do a more productive job, will also be discussed.

4. "Maintenance in Small Plants (Up to 50 Maintenance Employees)."

Moderator: H. D. Sprenger, Maintenance Engineer, American Blower Div., American Radiator & Standard Sanitary Co., Columbus, Ohio.

What maintenance operations are essential to the small plant; how these operations can be carried on in the simplest way; how responsibility for maintenance operations can be combined with responsibility for production, are among the topics of this panel discussion. Other questions such as how much preventive maintenance, how much planning and scheduling, how much supervision, and how much cost control will be answered.

Members of the panel are: Svante Eikrem, Plant Engineer, Hyster Company, Portland, Oregon; Howard Leadbeater, Plant Engineer, American Pulley Co., Philadelphia, Pa.; C. H. Pedersen, Project Engineer, Superior Tube Co., Norristown, Pa.; Homer A. Smith, Plant Engineer, Diamond Alkali Co., Newark N. J.; James M. Weeks, Plant Engineer, Proto Tool Div., Pendleton Tool Industries, Inc., Los Angeles, Calif.

O. J. Seidl

H. W. Collins

J. E. Mallow

G. W. Lees, Jr.

C. R. Toothaker

C. G. Wyder

5. "Maintenance in Little Plants (Up to 10 Maintenance Employees)."

Moderator: C. Gale Kiplinger, Chairman, Maintenance Steering Committee, National Aniline Div., Allied Chemical & Dye Co., Buffalo, N. Y.

The same problems as in Session 4 will be discussed here.
Members of the panel are: J. M. Abernathy, Plant Engineer, American Cyanamid Co., Kalamazoo, Mich.; W. C. Bradley, Plant Engineer, Cowles Chemicals Co., Skaneateles Falls, N. Y.; Morton Charnley, Jr., Plant Engineer, Rapids-Standard Co., Grand Rapids, Mich.; A. J. Monta, Chief Engineer, Welch Grape Juice Co., Westfield, N. Y.

6. "Labor Relations."

Chairman: Frank I. O'Leary, Vice President, Industrial Relations, Monarch Machine Tool Co., Sidney, Ohio. Speakers: Frank L. Bradley, Plant Engineer and Engineering Manager, Forstmann Woolen Co., Passaic, N. J.—"In Union Shops"; and George Wallace, Plant Engineer, Gillette Safety Razor Div., Gillette Co., Boston, Mass.—"In Non-Union Shops."

Mr. Bradley: Effective labor relations are established on a day-to-day basis between the supervisor and his mechanics and/or steward. The success of these efforts is contingent to a large degree on effective use of negotiated methods available to the foreman and his ability to get along with men.

7. "Maintenance in Metal-Working Plants."

Discussion leader: Otto J. Seidl, Plant Engineer, East Chicago Div., Combustion Engineering, Inc., East Chicago, Ind.

Training, incentive systems, planning and scheduling, preventive maintenance, lubrication, standards, etc., will be dealt with. A digest of what others in the field are doing will be given by the men responsible, and there will be an opportunity to evaluate successful programs.

8. "Maintenance in Petroleum Processing Plants."

Discussion leaders: H. W. Collins, Supervisor, Plans and Coordination, Construction and Maintenance Div., Port Arthur Works, Texas Co., Port Arthur, Tex.; and J. E. Mallow, Superintendent, Mechanical Maintenance, Natural Gasoline Dept., Phillips Petroleum Co., Bartlesville, Okla.

Maintenance problems in three types of plants—petroleum refineries, petrochemical and gas liquids recovery plants, will be the subject of this round table, question and answer session. Problems to be dealt with will include: turnaround practice, procedure for initiation and authorization of work, planning and scheduling, spare-part and stand-by equipment practice, preventive and routine maintenance, records, training, and organization.

9. "Maintenance in Pulp and Paper Mills."

F. S. Stopps

Moderator: F. S. Stopps, Plant Engineer, Richmond Printing Plant, Reynolds Metals Co., Richmond, Va.

The experience of the members of the panel with scheduled shutdowns, weekend work, preventive maintenance and stand-by equipment in reducing production schedule interruptions, should be of benefit to anyone responsible for the maintenance of equipment.

Members of the panel are: Jefferson Farmer, Plant Engineer, St. Croix Paper Co., Woodland, Me.; L. V. Graham, Jr., Assistant Superintendent of Maintenance, Kraft Div., St. Regis Paper Co., Pensacola, Fla.; R. J. Lundgren, Assistant Master Mechanic and Chief Maintenance Engineer, Crossett Paper Mills Div., Crossett, Ark.; D. M. Mellor, General Field Superintendent, West Virginia Pulp and Paper Co., Luke, Md.; and Ralph A. Peat, Maintenance Engineer, Strathmore Paper Co., West Springfield, Mass.

10. "Maintenance in Research and Development Laboratories."

Discussion leader: George Walter Lees, Jr., Plant Engineer, Murray Hill Laboratory, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

The session will be devoted to the problems of maintaining the plant and equipment in research and development laboratories with emphasis on the areas of difference between these organizations and the average industrial plant or office building.

A. O. Mortenson

M. J. Wohlgemuth

C. E. Boettcher

J. A. Eckstein

W. A. Gerstmyer

R. A. Nelson

11. "Maintenance in Rubber Plants."

Discussion leader: Carl R. Toothaker, Plant Engineer, Naugatuck Footwear Plant, United States Rubber Co., Naugatuck, Conn.

Maintenance in a modern rubber and plastics plant producing a multiplicity of products results in the need for new techniques and skills. Discussion will attempt to bring out the solutions to these common problems in addition to new techniques on existing equipment.

Tuesday morning, January 28, 9:15 Amphitheatre

12. "Fundamentals of Preventive Maintenance."

Moderator: Carl Wyder, Plant Maintenance and Engineering Editor, "Factory Management & Maintenance."

Topics for this discussion will include: what preventive maintenance is; what its benefits are; and what must be done to properly prepare for it. In addition, the session will deal with the establishment of inspection frequencies; writing inspection manuals and job descriptions; making job assignments, establishing responsibilities and working out reports.

Members of the panel are: Forrest S. Fischer, General Maintenance Foreman, Moloney Electric Co., St. Louis, Mo.; Bernard J. Robichaud, Maintenance Engineer, Toni Co., Div. Gillette Co., St. Paul, Minn.; John Van Coevering, Supervisor, Facilities Engineering, Magnetic Materials Section, General Electric Co., Edmore, Mich.

13. "Fundamentals of Planning and Scheduling."

Moderator: A. O. Mortenson, Special Assistant to Chief Engineer, St. Regis Paper Co., Pensacola, Fla.

This will be an exploratory session, on such subjects as planning and scheduling an organized job; organizing plant personnel; work orders; records and reports, job descriptions; engineering involved; and the extent to which planning and scheduling can be mechanized.

Members of the panel are: John V. Mansheim, Maintenance Engineer, W. A. Sheaffer Pen Co., Fort Madison, Ia.; Stuart A. Snyder, Head, Maintenance Control Div., Public Works Dept., U. S. Naval Gun Factory, Washington, D. C.

Tuesday evening, January 28, 7:30 (Concurrent) Palmer House

14. "Upkeep of Electric Motors."

R. B. Moore

Chairman: R. B. Moore, Manager, Mining and Chemical Engineering Unit, Systems Application Engineering Section, Apparatus Sales Div., General Electric Co., Schenectady, N. Y. Speaker: M. J. Wohlgemuth, Assistant to Manager, Service Dept., Apparatus Div., Westinghouse Electric Co., East Pittsburgh, Pa.

Mr. Moore: Session will deal with suitability of motors for jobs as to kind and size; inspection frequency and what to look for; repairs that can be made during inspection; lubrication; how to inspect electrically and mechanically; replacement and standby policies.

Mr. Wohlgemuth: This paper presents inspection programs which may be new to many. Lubrication and handling of bearings is stressed, as well as a brief discussion of spares.

15. "Setting and Maintaining Sanitation Objectives."

Chairman: Clarence E. Boettcher, Plant Services Manager, A. B. Dick Co., Chicago, Illinois. Speakers: John A. Eckstein, Special Projects Engineer, Oscar Mayer & Co., Madison, Wis.; and William A. Gerstmyer, Supervisor, Sanitation and Accident Prevention, American Sugar Refining Co., Baltimore, Md.

Mr. Boettcher: The discussion will present methods of solving sanitation problems. Those attending the session will be able to tell their experiences in formulating a program.

Mr. Eckstein: Relationship between plant sanitation and plant maintenance from the point of view of cost will be the subject of this paper. A formula for determining efficiency of sanitation in relation to cost per square foot and average hourly wage is to be presented.

Mr. Gerstmyer: Cost of maintaining satisfactory sanitary conditions in a food processing plant can be very high. This discussion reviews the organization and operation of an effective sanitation program in the sugar refining industry.

W. E. Fore

R. H. Morris

B. J. Drummond

K. N. Banthin

P. J. Gurklis

G. M. Gartner

16. "Getting Work Cooperation from Maintenance Employees."

Chairman: Ray A. Nelson, Maintenance Superintendent, Cliffs Dow Chemical Co., Marquette, Mich. Speaker: Wallace E. Fore, Plant Engineer, Los Angeles Div., North American Aviation, Inc., Los Angeles, Calif.

Mr. Nelson: This session will cover assignment of duties; fixing responsibilities, setting up standards; establishing and publicizing objectives; meeting of supervisors with their workers for communications; fitting the shop stewards into the picture; and contests, awards, and other devices to induce a spirit of friendly rivalry.

Mr. Fore: The key to improving maintenance worker effectiveness and worker cooperation, is proper supervision. Personal skill, and conceptual skill must be blended in the proper proportions at every level of maintenance supervision, if we are to gain the maximum effectiveness from our maintenance work forces. A method for isolating maintenance leadership problem areas as a means of improving worker effectiveness is to be discussed.

17. "The Broad Responsibilities of Plant Engineering."

Moderator: R. H. Morris, Editorial Director, PLANT ENGINEERING, *Barrington, Ill.*

Plant layout, and design; special equipment design; tool design; purchase of plant equipment; project control; waste disposal, water conservation and air pollution, are among the subjects to be discussed by this panel. Additional subjects will be work orders, preparation and estimating; and control of industrial engineering procedures as they apply to plant upkeep.

Members of this panel are: O. B. Patton, Plant Engineer, Towmotor Co., Cleveland, Ohio; William C. Wallin, Chief, Plant Engineering Dept., Western Electric Co., Winston-Salem, N. C.; and P. P. Weidinger, Manager, Plant Engineering and Tool Design, Bailey Meter Co., Cleveland, Ohio.

18. "Impact of Automation on Plant Engineering and Maintenance."

N. P. Bashor

Chairman: Nelson P. Bashor, Director, Electric Controls Div., W. F. & John Barnes Co., Rockford, Ill. Speaker: B. J. Drummond, Plant Engineering Dept., Corporate Manufacturing Staff, Chrysler Co., Detroit, Mich.

Mr. Bashor: A report covering maintenance at Chrysler Corporation shows that automation equipment maintenance needs a different procedure from that used on machine tools. Largest single problem is the manner in which the part is contained and controlled. In a machine tool, the part is always held rigid, but in automation equipment, loose control only is available.

Mr. Drummond: Introduction of constantly increasing installations of automated operations has brought about changes in the philosophy of plant operation. How these changes are affecting operations of plant engineering and maintenance activities in Chrysler's plants; and their effect on the planning activities for setting up these operations will be discussed.

19. "Maintenance in Chemical Plants."

Discussion leaders: Kenneth N. Banthin, Supervisor, Construction and Maintenance, Clearing Plant, Visking Div., Union Carbide Co., Chicago, Ill.; and Peter J. Gurklis, General Superintendent of Maintenance Shops, Texas Div., Dow Chemical Co., Freeport, Tex.

Mr. Banthin: Round table discussion will open with area versus centralized maintenance and how and who from production department designates priorities for maintenance work. Conferees will be asked to designate which three subjects of their choice of 20 they then wish to discuss. A list of these subjects will be given conferees at the start of the session.

20. "Maintenance in Metal-Fabricating Plants."

Discussion leaders: George M. Gartner, Jr., Field and Maintenance Engineer, General American Transportation Co., Sharon, Pa.; and C. J. Nocar, Assistant to President, E. F. Hauserman Co., Cleveland, Ohio.

Main subjects for discussion will be maintenance problems in plants making products from sheet metal and shapes—planning and scheduling repairs to vital machines; maintaining central hydraulic system; and maintaining power rolls used for positioning tanks for fitting and welding; also, inspection routines, standards and reports for various kinds of production equipment such as shears, brakes, rolls, forming presses and punch presses.

C. J. Nocar

L. Schoenherr

W. E. Ransome

P. A. Repino

A. B. Millman

H. C. Ballman

21. "Maintenance in Food-Processing Plants."

Discussion leaders: Joseph Mondschein, Plant Engineer, Thomas Lipton, Inc., Hoboken, N. J.; and Louis C. Schoenherr, Plant Engineer, New England Confectionery Co., Cambridge, Mass.

Mr. Schoenherr: Maintenance of equipment that is most important and necessary for manufacturing confectionery will be discussed along with special maintenance requirements of various pieces of equipment.

22. "Maintenance in Foundries."

Discussion leaders: William E. Ransome, Manager of Maintenance, Forging and Casting Div., Allegheny Ludlum Steel Co., Detroit, Mich.; and Philip A. Repino, Plant Engineer, Lebanon Steel Foundry, Lebanon, Pa.

Ideas on how to cope with problems involving lubrication, ventilation, inspections, building maintenance, records and scheduling will be exchanged at this round table session.

23. "Maintenance in Steel Mills."

Discussion leader: A. B. Millman, Superintendent of Maintenance, Aliquippa Works Div., Jones & Laughlin Steel Co., Aliquippa, Pa.

Subjects of discussion will include: problems of inspection and repair of units with varying operating patterns including continuous operations such as blast furnaces, 20 turn per week operations of primary and finishing mills and 15 to 18 turn per week operations on same. Discussion will be centered around the best utilization of maintenance personnel, the coordination of repairs with operations, extent and frequency of inspection and need for standby equipment.

Wednesday morning, January 29, 9:15 Amphitheatre

24. "Fundamentals of Maintenance Cost Control."

Moderator: H. R. Harbeson, Superintendent, Plant Construction and Maintenance Dept., Sutherland Paper Co., Kalamazoo, Mich.

Panel will cover cost records that the average plant should keep. Suggestions as to what cost reports should be made; a. for management, b. for use of the maintenance department. Show how costs reports and analyses can be used to measure the effectiveness of the maintenance job; how records can be used in deciding on equipment replacement. There will also be some discussion on estimating; preparation of maintenance budgets; and comparison of performance with budget.

Members of the panel are: S. J. Beaton, Supervisor, Maintenance Control, Industrial Products Dept., Canadian General Electric Co., Ltd., Toronto, Ont.; E. M. Goodbar, Superintendent of Maintenance and Utilities, Pittsburg Works, Columbia-Geneva Steel Div., United States Steel Co., Pittsburg, Calif.; and John W. Green, Plant Facilities Engineer, Leeds & Northrup Co., North Wales, Pa.

25. "Preventing Air and Water Pollution."

E. J. Cleary

Chairman: Mr. L. C. Morrow. Speakers: Harry C. Ballman, Manager, Field Engineering Services, Bituminous Coal Institute, Washington, D. C., and Edward J. Cleary, Executive Director and Chief Engineer, Ohio River Valley Water Sanitation Commission, Cincinnati, Ohio.

Mr. Ballman: Air pollution control activities have increased rapidly over the last 10 years through advanced techniques and improved equipment. Plants located in metropolitan areas of high population and industrial concentration should evaluate their air pollution problem and correct as needed.

Mr. Cleary: Why the maintenance engineer should be concerned, what he should be concerned about and how he can tackle the job in his own plant are the three phases of water pollution control to be discussed.

Wednesday evening, January 29, 7:30 (Concurrent) Palmer House
Repeat of Sessions 2, 3, 4, 5, 6, 14, 15, 16, 17 and 18.

Preventive Maintenance Procedures and

FORM 13-3 2M

EQUIPMENT RECORD

NO. 636	DESCRIPT MERRY-GO-ROUND			LOCATION T-68 CASTING
MFG. NAME AND ADDRESS DEPT. 5501 TOOL ROOM				
SERIAL T-68-3497	MODEL	TYPE SPECIAL	SIZE 6 HEADS	CAT. NO.
MFG. ORDER NO.	P. O. NO.	INSTALLED 7-54		

MISC. DATA SIX- 3/4 HP MOTORS. BELLOWS INDEX TABLE. CYCLE TIME 16 SECONDS. DESIGNED TO RUN ONE MILLION PIECES.

SPARE PARTS TO STOCK AND SUPPLIER TOOL ROOM WILL FURNISH ALL NON-STANDARD PARTS REQUIRED.

HISTORY OF REPAIRS, ETC.

DATE	W. O. NO.	BY	DESCRIPTION
9-3-54	3479	PH	P.M. INSPECT OKAY
10-7-54	3761	LD*PH	MISSED INDEX. REALIGN ALL HEADS. REPLACE SHOT PIN ASSY. INSTALL INTERLOCK.
11-11-54	4048	RS	ELECT. PM INSPECT OKAY.
12-4-54	4232	RS	RESET OVERLOAD RELAY HEAD 3. DULL DRILL.

Fig. 1. Equipment Record Card on which was recorded all necessary pertinent data when crews were collecting nameplate data, machine locations, etc.

ELECTRIC MOTOR

NO. 16				LOCATION CENTRAL STORES	
H.P. 1/3	RPM 1725	VOLTS 110-120	AMP.	PHASE 1	CYCLES 60
MODEL BALL BEARING. CONT DUTY.		TYPE OPEN	FRAME 1130	CODE	TEMP. RISE 40C
MAKE "KASSON" GEN'L DIE & STAMPING CORP.		SERIAL NO. NONE		DATE INSTALLED SPARE	

REMARKS: DOUBLE SHAFT ½" x 1½ WITH FLAT. REVERSIBLE BY EXTERNAL CONNECTION.

MAINTENANCE RECORD

DATE	WO NO.		BY
11-9-53	1633	ELECT. PM INSPECT. CHECKOUT OKAY. CONDITION GOOD.	RS

FORM 13-2 1M

(CONTINUED ON OTHER SIDE)

Fig. 2. This is a typical motor data card that can also be used. Such use was abandoned by author in his particular plant for reasons stated in text

Forms in Action—A Record of Experience

By **BURKE W. WOMBACHER**, Plant Engineering Consultant, Redondo Beach, Calif.

FORTUNATELY FOR industry, an ever-increasing number of plant engineers are receiving approval from management to get going on their preventive maintenance programs. From time to time I get calls from some of these newly successful salesmen of preventive maintenance. Usually they want to know if there are standard forms of procedures to be used. Also, I am happy to get calls from some of the old timers who continue to work to improve their programs; they want to know "what's new?" and to compare experiences.

These questions can be answered very briefly: I do not know of any preventive maintenance forms or systems that are new, strange or startling. As to standard forms or procedures, I cannot conceive that such a thing is possible.

My findings are that a forms and procedures system must be tailored to fit the needs of each individual plant; even tailored differently for separate areas or sections of a plant in some cases. Also, forms and procedures that might be a necessity in one plant can easily be a waste of time in another.

This first time I was successful in "selling" a PM program elated me to such a degree that I was determined to put in the finest system that man could devise.

Formulating Plan: I already had a pile of data on hand, and immediately started calling and writing to anyone that I thought could help me, asking "Are there standards?" and "What's new?"

Fig. 3. First memo sent to maintenance men when PM program was put into effect

cc: All Management
All Supervision
Bulletin Boards

To: All Maintenance Personnel
From: Plant Engineer

Subject: Preventive Maintenance Inspections, General Instructions.

1. **Special forms headed "Machine Inspection Report" or "Electrical Inspection Report" are to be used as directed for all preventive maintenance inspections.** As a part of inspection, inspectors will make all necessary miscellaneous minor repairs and adjustments such as tightening nuts and bolts, minor leaks in valves and piping, tighten wire connections, etc. These small items need not be mentioned on reports.

   After completing inspection, items of larger scope requiring parts, labor, or material will be done is directed by maintenance foreman against repair work orders. Inspector will submit inspection report to foreman promptly after work is completed, and foreman will direct further action to be taken.

2. **Explanation of Machine Inspection Report check list items: A separate bulletin will be issued covering Electrical Inspection Report items.**

   a. Safety—Inspector will check machines carefully to see if all mechanical equipment is amply guarded. Are splash shields or chip shields needed? Also note general operation and work area so that a slippery floor, aisle obstruction, unsafe piling, or other such items relative to safety can be noted for action.

   b. Mechanical—Check condition of belts, sheaves, chains, sprockets, gibs, alignment of drives, machine level, etc., to determine what is required to put machine into peak mechanical operating condition. Check with foreman and set-up man to learn if they know of any troubles on machine.

   c. Lubrication—Lubrication is covered by a separate maintenance lubrication program, but inspector will examine coolant and lurication systems and equipment. This is planned to serve as a cross check to help the oilers who may have overlooked a clogged oil line, broken drip oiler ,etc.

   d. Electrical—Mechanical inspectors will make a visual inspection only as a cross check aid to help the electrical department who also have a preventive maintenance program. They in turn will note, but not repair, any mechanical items that they find.
   Remember that the 480 volt service to most equipment can be a deadly thing. Mechanics are not to move motors or do any other work on electrical equipment, but they will report such items as hot motors, loose switch boxes or conduit, etc.

   e. Piping—Check all piping for leaks. Tighten bonnets and handles on valves. Check related equipment such as regulators, governors, gages, filters, air line oilers, pumps, etc.

3. **Parts to stock column—As we want to develop a spare parts supply of important items, we must first compile data on what is needed. Inspector is requested to make a considered survey of machine to suggest what parts are most likely to fail, such as sheaves, belts, chains, sprockets, gear, clutch discs, bearings, etc.**

4. **Notes column, etc.—Maintenance foremen will hold meetings to further explain and answer questions to clarify procedures and details of the intent and purpose, etc., of this maintenance program.**

The response was immensely gratifying, and a wealth of data, sample forms and advice was received. From this assembly of material I resolved a system of forms and procedures, and through the years continued to improve on it through experience and common sense. My first system, I soon discovered, was much too elaborate.

This means that what I use today is an assemblage of bits of plagiarized material that is basic but flexible and easily tailored to adjust it to the needs of most any plant.

What I have to offer that is new is a report on my experience with this system in action, as I used it during a recently completed four year tour of duty as plant engineer for a large local plant. This plant consisted of a large machine shop and equally large assembly operation.

The best advice that I can possibly give from this experience is to keep your system simple. I quickly learned that it is very easy to get so overburdened with the collection of records and data, that you will put in time and effort far in excess of any possible value received.

Making clerks out of yourself or your maintenance people will decrease the effectiveness of their on-the-job efforts. As you know, there is no substitute for on-the-job supervision, especially clerical work.

Plan in Action: This is how we planned our preventive maintenance program and put it into effect at my last place of employment:

1. A plot plan drawing was prepared showing every machine and piece of equipment that was to be covered by our program. This drawing was regularly kept up to date. On it every piece of equipment was given a special number from 1 to more than 1700.

2. Next we purchased 2000 aluminum number plates that were distinctive in appearance and numbered from 1 to 2000. These plates were later fastened by two Parker-Kalon drive screws in two No. 41 drilled holes, and located at the most clearly visible spot on each piece of equipment.

In numbering the plot plan we started by numbering all like machines in sequence, so that all turret lathes were number 1 to 36, etc. Four or more following numbers of each like group were left unassigned at the start, so as to allow for additions or changes in each group.

Reason for numbering machines in groups was that it made it simpler and more effective when recording data and when planning or performing preventive maintenance service.

The effectiveness of having mechanics service all similar machines, instead of jumping around among unlike machines, is obvious.

3. The crew that installed the number plates on the machines also collected all the nameplate data, serial numbers, etc., and this was recorded on the equipment record card, Fig. 1, by the department clerk after being screened by the plant engineer.

Note that the card shown in Fig. 1 has very little data recorded, and this much or even less data was

Fig. 4. Memo that followed Fig. 3. This was sent to electrical maintenance

cc: All Management
All Supervision

To: All Electrical Maintenance Personnel

From: Plant Engineer

Subject: Electrical Preventive Maintenance Inspections, General Instructions.

This bulletin is issued to supplement the bulletin issued to all hands yesterday. The purpose of this bulletin is to define the intent of some of the items that appear on the electrical inspection report check list.

1. **Motors**

Routine Procedure

Cleaning—Blow dirt out of motor with compressed air; not over 50 psi, and wipe off.

Temperature—Check temperature of housing and bearings by feel.

Alignment—Check tightness of motor base bolts, end play and alignment of pulleys and shafts. Listen for signs of bearing wear.

Guards—See that guards are clean, in proper position and securely fastened.

As Required or Directed

Lubrication—Check lube level in gear motors, etc. When lubing bearings, be sure to remove drain plugs so as not to build up pressure in bearings.

Insulation—Test insulation with Megger, especially where motors run in wet or oily location or high ambient temperature.

Clearance—Check rotor clearance with feeler gage.

Load—Check operating speed with RPM counter, and motor load with ammeter.

Brushes—Check for wear or cracks and see that they ride freely in brush holder under correct spring pressure.

Commutators—Clean commutators or slip rings with suitable solvent. Dress if necessary with dressing stone or fine sandpaper. Never use emery cloth.

2. **Relays, Contactors, Drum Controllers**
Cleaning—Blow out dirt and chips and wipe off in and out.
Contacts—Check magnet faces on contactors for cleanliness. Check contacts for alignment or burning. Burned contacts can be sanded or filed and reset. Do not use emery cloth. Silver contacts are normally dark and should not be dressed.
Coils and Connections—Check coil mounting bolts and wire connections for tightness, etc.

3. **Circuit Breakers**—Trip circuit breakers several times to free up mechanism and let wiping motion clean contacts.

4. **Safety Switches (Disconnects).**
Contacts—Trip several times to clean oxides from contacts. Check alignment of the blades with the tension clamps. Check tension of clamps.
Fuse Clips—Check fuse clips and fuses for signs of overheating, and for size, alignment and tension.

5. **Other Items**—Electrical Maintenance Foreman will hold meetings to further explain and clarify procedures and details of this maintenance program.

typical of our practice. At first, I used to fill in such record cards more completely, but soon learned that such an assemblage of data was time consuming, unnecessary and generally useless. Cost, date of purchase, P. O. numbers, etc., could easily be found in accounting records or elsewhere on the rare occasions they were needed.

The history sections of the equipment record cards were kept up daily from the completed maintenance work orders that all closed out through the plant engineer's office and from the preventive maintenance inspection reports.

4. We also prepared motor record cards, see Fig. 2, and purchased another type of distinctive appearing aluminum number plate with a plan in mind to treat with all motors separately in a completely separate PM program.

However, during the delay time occasioned by getting the machine numbering underway, we had some maintenance meetings and reconsidered. Our initial plan for treating with motors separately was abandoned beyond the numbering and recording of about fifty spare motors.

The reasons resolved for this abandonment were:

a. Motors are so durable and long-life and trouble free, that we felt we would never accumulate enough motor repair history to make worthwhile the effort of establishing records.

b. Trouble in quantity could be expected with other electrical components such as relays, switchgear, etc., but these would not properly record on a motor record card.

c. Motors can be expected to remain with machines and even outlive the machines, therefore we decided that all electrical equipment and motors connected with a machine would be treated as being a part of the machine and recorded on equipment record card, Fig. 1.

d. Collection of frame size, shaft size and other such motor data was judged useless because this data is always readily available on the motor nameplate if ever needed.

e. Useful data to be retained was horsepower for purpose of connected load calculations, etc., and we included this equipment on record card, Fig. 1.

Putting Plan into Effect: Putting our plan into effect was accomplished as follows:

1. Our first step was to hold meetings with management and production supervision with the theme being "cooperative maintenance."

The plant engineer stressed that the maintenance department's efforts were to be directed in such a manner as to never interfere with production, but instead to serve production by working to insure uninterrupted output by eliminating breakdowns.

In turn, production and management pledged "realistic" cooperation. They promised to make machines available for inspection, adjustment and repair whenever they could.

And, of course, as their lost-time sheets for machine breakdowns became fewer and fewer, they continued to be even more impressed with preventive maintenance effectiveness.

2. Next step was the indoctrination of the maintenance employees. A copy of a Machine Inspection Report was attached to each copy of the General Bulletin, Fig. 3. This General Bulletin came from the plant engineer and went to all hands. Its instructions were followed up by training sessions led by the maintenance supervisor.

Immediately following the issuance of this bulletin a second bulletin, Fig. 4, was issued to all electrical maintenance employees. In addition, a copy of the electrical inspection report, Fig. 5, was attached to this second bulletin.

The maintenance supervisors in their training meetings especially emphasized that "shoemakers should stick to their lasts" electrical and mechanical men would cooperate with each other by noting and reporting troubles not in their areas of work effort. **End**

Fig. 5. This is a copy of the electrical inspection report that accompanied the memo shown in Fig. 4. The memo defined action to be taken on the report

ELECTRICAL INSPECTION REPORT

MOTOR NO.		MACH. NO.	LOCATION
W. O. No.	Inspector		Date

Motor Check List

Safety	Temp.	Bearings	Lube
Sheave	Sprocket	Shaft	Pinion
Mounting	Alignment	Wiring	Conduit
Connections	Mechanical	Operation	Clean

Control Check List

Safety	Manual Starters	Magnetic Starters
Relays	Push Buttons	Reverse Contactors
Micro Switches	Heaters	Contactor Tips
Operating Coils	Shading Coils	Magnet Faces
Connections	Wiring	Conduit
Control Transformer	Circuit Breaker	Fuse & Clips
Grounding	Plug Caps & Outlets	Clean

AS DIRECTED

Megger Speed Load Clearance Other

Notes & Data

No.	Note	Completed Name - Date - W.O. No.

Also use reverse side of this sheet for notes & data

Electric Maint. Foreman Notes and Remarks:

Approved
Foreman

Plant Engineer

You Have To Sell Maintenance

1. To Top Management

2. To Maintenance Employees

By W. C. COOLEY, Foreman of Maintenance, Lockheed Aircraft Corp., Missile Systems Div.

Why Sell Maintenance?

FOR COUNTLESS YEARS, ever since there have been machines and buildings to maintain, the maintenance crews in most companies have been considered by management a necessary evil. They have received little or no credit for work done and a great deal of criticism for work delayed. Often, maintenance is the first department to receive budget cuts and the last department to receive budget increases. The equipment that maintenance gets often is the cast-off of the production departments, and the space they are given to operate in is usually what is left after all other space allocations are made.

If this is the case in your company, the fault is entirely yours, and it is time you started *selling* maintenance.

Maintenance is a service organization. Its existence and sole reason for being is to assist the parent company in producing an end-product or service efficiently, inexpensively and on schedule. Any way that you can improve your service to the company is a credit to you, but you will only get this credit if the people you work for and top management know of the improvements you have made. You have to *sell* maintenance. You have to show the necessity for it, the money saved by maintenance and the increase in production brought about by maintenance. How can you do this?

1 Selling By Work Charts—One of the best ways to sell maintenance is by means of charts and graphs that show your work accomplishment. These charts may be in any form but should always indicate the volume of work accomplished in any one field. You may plot maintenance personnel curves against work performed or work backlog as shown in Fig. 2, or you may plot square feet of floor space against janitorial personnel, or dollars spent on machinery maintenance against capital investment in machinery. Any facts and figures that you can pictorialize will help to show management the work you are doing. These charts and graphs also serve a second purpose. They show that you are aware of the costs of your department and have them under study.

Selling By Reports—If, during the normal week's activities, you will jot down the important things that happened, jobs that are accomplished or projects undertaken, and at the end of each week type up a weekly activities report, this will again give you an opportunity to show the accomplishments of your department.

In addition to the weekly report, an annual report of all activities carried on in the maintenance department is extremely important. This annual report should include statistical records such as amounts of work done, savings realized, and comparative figures from the previous year's showing work improve-

Fig. 1. Paper "Hero" medal awarded those kindly souls who are thoughtful enough to call maintenance at Lockheed and thank them for the help rendered

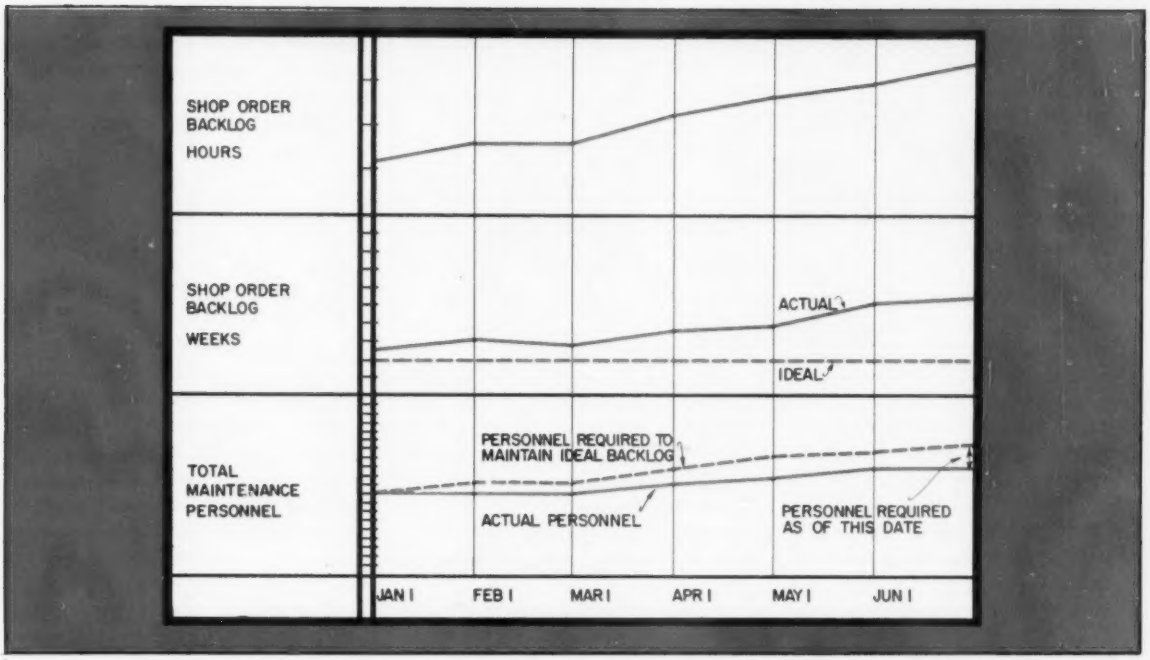


Fig. 2. Charts like this one can help show management where the maintenance manpower goes and why more is needed

ment, increased efficiency, and increased savings effected. Sufficient copies should be sent to your superior to insure that he will be able, in turn, to forward copies to his superiors and other interested parties if he so desires.

Selling By Hand-Outs—In selling maintenance, it should be remembered that it is equally important to sell maintenance to all plant personnel as well as to management. The theme of your selling campaign should always be that you are there to serve. You want to give better, quicker, and more comprehensive service. That is your aim. This sales campaign can be aided by periodic handouts, like the one shown in Fig. 3, that call attention to the ways you serve.

Your night janitors can place these handouts on each desk at night for all personnel to see the following morning. In a static organization these handouts need be distributed only once a year, or even less. In an expanding organization, more frequent distribution, should be made.

One handout that has proven to be very successful here at Lockheed Missile Systems Division is the "Battle of the Butts" handout, shown in Fig. 4. The night janitors place one of these handouts with an ash tray on each desk or drawing board that has a litter of cigarette butts on the floor around it. In most cases the problem is quickly solved by this method.

One additional selling aid that you

SCOTCH TAPE IS NOT SUITABLE FOR COLLAPSING CEILINGS. WHY NOT CALL MAINTENANCE?
DON'T KICK THE POOR MACHINE. GIVE IT SOOTHING ATTENTION BY A QUICK CALL TO MAINTENANCE.
THIS METHOD IS FAR TOO NOISY. INSTEAD CALL A QUIET REPAIRMAN FROM MAINTENANCE.
MAINTENANCE HAS A LONG POLE WITH A WHATZIT FOR REPLACING LIGHTS. IT BEATS BOOKS ALL HOLLOW.
CALL MAINTENANCE FOR QUICK RELIEF FROM HEAT, COLD DRAFTS AND STUFFY FEELINGS.
YOUR DRINKING FOUNTAIN ACTS UP. DON'T SWITCH TO COFFEE. JUST CALL A HANDY PLUMBER FROM MAINTENANCE.
IF THE PAINT IS BEGINNING TO PEEL, DON'T USE WALLPAPER. CALL MAINTENANCE! WE HAVE PAINT.
DON'T CALL MAINTENANCE FOR ANY NEW CONSTRUCTION. THAT'S A JOB FOR PLANT ENGINEERING. (SIMPLY FILL OUT FORM 3166 EXPENDITURE REQUEST AND FORWARD). WHEN YOU NEED REPAIRS ON EXISTING FACILITIES GIVE US A CALL!
DON'T DO IT YOURSELF...CALL MAINTENANCE!

Fig. 3. Indoctrination handout, left on desks of new employees and repeated each year, not only sells the services of maintenance but also points out that plant engineering is the department to call when new construction is the problem

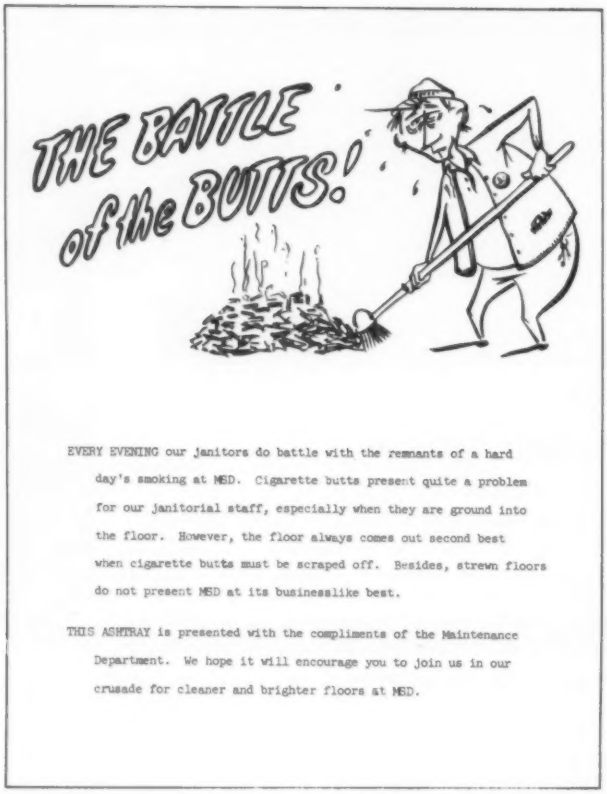

THE BATTLE of the BUTTS!
EVERY EVENING our janitors do battle with the remnants of a hard day's smoking at MSD. Cigarette butts present quite a problem for our janitorial staff, especially when they are ground into the floor. However, the floor always comes out second best when cigarette butts must be scraped off. Besides, strewn floors do not present MSD at its businesslike best.
THIS ASHTRAY is presented with the compliments of the Maintenance Department. We hope it will encourage you to join us in our crusade for cleaner and brighter floors at MSD.

Fig. 4. "Battle of the Butts" handout is left by janitors for messy souls who litter floor around desks and workbenches. It seems to have had desired effect

might consider would be an award system, whereby personnel who express appreciation or thanks for a maintenance job well done are awarded a medal. This type of award points out maintenance's service role, promotes good humor among employees and is very inexpensive. It also calls attention to the fact that, nowadays, in the rush of modern business, fewer and fewer people take time out to express appreciation for work well done. Here at Lockheed Missile Systems Division, maintenance awards a red paper "HERO" medal, Fig. 1, complete with safety pin, to each person who expresses appreciation or thanks for a job well done.

Selling by Company Paper—Almost every large or medium sized company has a newspaper, house-organ, or other publication for its employees. Most of the time, the editors of these papers are constantly seeking stories to fill the issues. If you can write articles telling about the variety of work performed by maintenance, the varied backgrounds of maintenance personnel or other articles of general interest, these articles will help immensely in bringing maintenance into the limelight.

You are the chief salesman. The big job of selling maintenance falls on you. Your superiors calculate the efficiency and effectiveness of the maintenance performed by your own efficiency and effectiveness.

As your prime job is to sell maintenance to your immediate superior, there are a few basic rules you should observe in order to do a successful selling job. These rules are listed below—not in order of importance as they are all equally important.

1. Be aware of everything that is going on within the maintenance department. This is no easy task but it can be done. You need not know all the minute details of each current job but be sure your supervisors keep you posted on the status of all work.

2. Never alibi. Excuses are easily spotted and never tolerated.

3. Be proud of your maintenance department, its capabilities, and the personnel in it. Point with pride to successful jobs or to outstanding maintenance personnel.

4. Dress well. Don't be a "working head" of maintenance. Wear clean clothes, neckties and keep your shoes polished. This may appear to be very basic, but too many maintenance department heads don't realize the importance of this.

5. Never lose your temper. People often call maintenance time after time to find out why some insignificant small job hasn't been done. Probably this job has been temporarily bypassed because of more important work. Even if these people become abusive in their language, never respond in the same tone. Try to explain why the job hasn't been done and assure them it will be as quickly as possible.

6. Last, but not least, everywhere you go, everyone you talk to, continually *sell* maintenance. Remember — without maintenance, production stops, utilities cease, and companies go out of business.

Selling Maintenance to Maintenance

2 EXPERIENCE HAS SHOWN that labor costs of any type vary inversely with the skill and efficiency of the employee. Everyone knows that the skilled, efficient employee produces more with greater accuracy than the inefficient, unskilled employee. However, one of the factors most commonly overlooked in attempts to build increased skill and efficiency into employees is the effect an employee's morale has upon his skill and efficiency.

The employee with high morale is a better worker, steadier, and usually a highly efficient employee. The cost of building high morale in your department is slight, and the rewards are high. It's your job primarily, as a department manager. All your work can be described in the few brief words in that you must sell maintenance to maintenance.

First, let us discuss what factors affect the morale of your employees. Then, knowing these factors, we can discuss methods of selling maintenance to your employees.

Orientation—A well informed employee is a contented one. Nobody likes working in the dark, not knowing what he's doing, nor why. Orientation of new employees is especially important. You should instruct your supervisors to spend as much time as possible, preferably not less than an hour, explaining to his new employees what is expected from them, how the company operates, what part they play in the picture, and what, precisely, will be their job. This orientation is not a one-time job. It is a continuing responsibility.

Your employees should be told everything of a factual nature about their job, their department and company, providing the information is not classified. They should be kept well-informed, not only about technical aspects of their job, such as answers to the "Why am I doing this?" question so often asked, but also about items of general interest. Extreme care should be taken to divorce fact from rumor, and only fact should be given out. Most important, let them know *what you expect from them.*

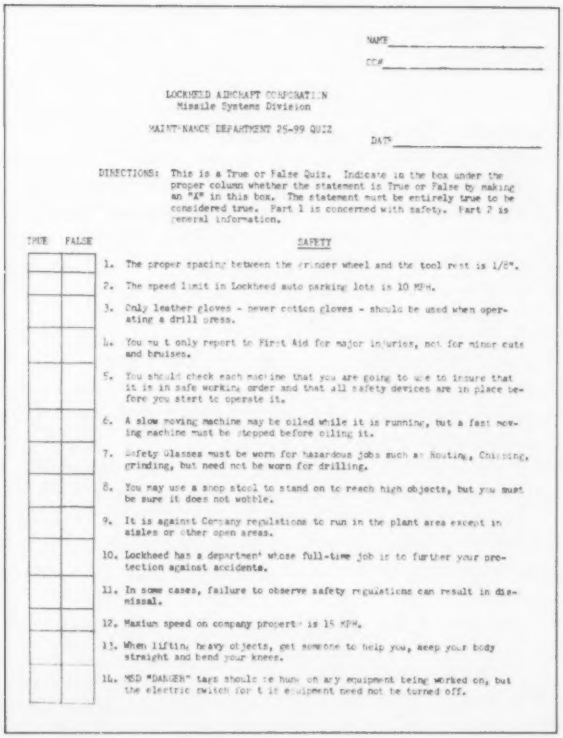
Confidence in Supervision—Nothing lowers the morale of an employee more than lack of confidence in and respect for his Supervisor. If your Supervisors do not command the respect of their employees, they should be replaced. If they follow the six rules of good supervision, honesty, conscientiousness, fairness, firmness, thoughtfulness, and open-mindedness, they will have no problem commanding the respect and confidence of their employees.

Pride in Work and Department—Craftsmen, and that's what most of your employees are and should be referred to as, do their best work when they are proud of their efforts. You and your supervision can instill this pride in your craftsmen by giving praise when due. Their pride should not be limited to their own job. They should be proud of their department, their company, and proud to be in the line of work they are. You can help build up this pride by being proud yourself—proud of the department, its record, its employees. This pride that you have automatically permeates to your employees. They feel it and are in turn proud.

Responsibilities—No member of supervision can do an effective job, nor will he be long content in his job, without some degree of responsibility delegated to him. However, few people realize that this same principle holds true for your craftsmen, or even your helpers. Give them responsibility to the limit you can within their job, and they will do better work. Explain the scope of the job, and what their responsibility will be. Don't fail to impress them with the fact that you are relying on them to be responsible for the completion of the job on time, and in a workmanlike manner. Also, that you are relying on them to point out any changes or improvements that should be made.

Open-Mindedness—In order to continually improve your department and increase the efficiency and quality of its work, your employees must be receptive to new ideas.

Fig. 5. These are the two sheets of a sample quiz given to Lockheed Missile Systems Division's maintenance men. It sparks their thinking and also informs them of company rules and regulations without seeming to belabor the issue



NAME_____

CC#_____

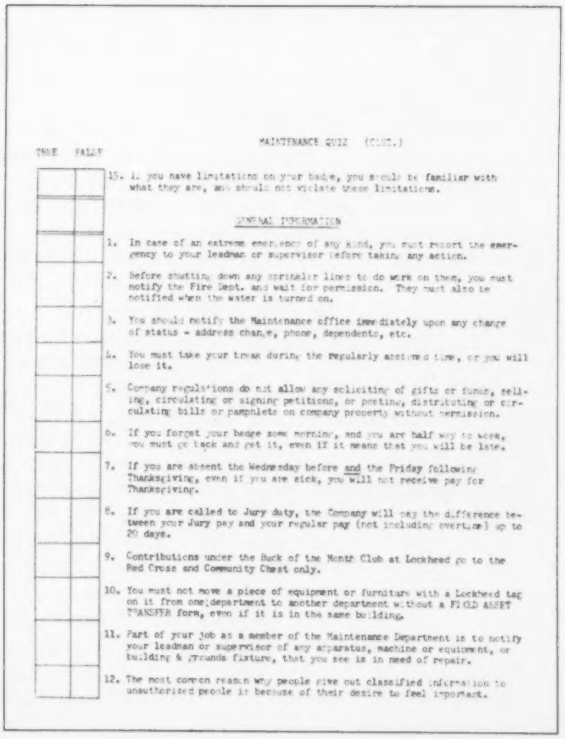
LOCKHEED AIRCRAFT CORPORATION
Missile Systems Division

MAINTENANCE DEPARTMENT 25-99 QUIZ

DATE_____

DIRECTIONS: This is a True or False Quiz. Indicate in the box under the proper column whether the statement is True or False by making an "X" in this box. The statement must be entirely true to be considered true. Part 1 is concerned with safety. Part 2 is general information.

TRUE	FALSE	SAFETY
		1. The proper spacing between the grinder wheel and the tool rest is 1/8".
		2. The speed limit in Lockheed auto parking lots is 10 MPH.
		3. Only leather gloves - never cotton gloves - should be used when operating a drill press.
		4. You must only report to First Aid for major injuries, not for minor cuts and bruises.
		5. You should check each machine that you are going to use to insure that it is in safe working order and that all safety devices are in place before you start to operate it.
		6. A slow moving machine may be oiled while it is running, but a fast moving machine must be stopped before oiling it.
		7. Safety Glasses must be worn for hazardous jobs such as Routing, Chipping, grinding, but need not be worn for drilling.
		8. You may use a shop stool to stand on to reach high objects, but you must be sure it does not wobble.
		9. It is against Company regulations to run in the plant area except in aisles or other open areas.
		10. Lockheed has a department whose full-time job is to further your protection against accidents.
		11. In some cases, failure to observe safety regulations can result in dismissal.
		12. Maxium speed on company property is 15 MPH.
		13. When lifting heavy objects, get someone to help you, keep your body straight and bend your knees.
		14. MSD "DANGER" tags should be hung on any equipment being worked on, but the electric switch for it if equipment need not be turned off.



MAINTENANCE QUIZ (CONT.)

TRUE	FALSE	
		15. If you have limitations on your badge, you should be familiar with what they are, and should not violate these limitations.
		GENERAL INFORMATION
		1. In case of an extreme emergency of any kind, you must report the emergency to your leadman or supervisor before taking any action.
		2. Before shutting down any sprinkler lines to do work on them, you must notify the Fire Dept. and wait for permission. They must also be notified when the water is turned on.
		3. You should notify the Maintenance office immediately upon any change of status - address change, phone, dependents, etc.
		4. You must take your break during the regularly assigned time, or you will lose it.
		5. Company regulations do not allow any soliciting of gifts or funds, selling, circulating or signing petitions, or posting, distributing or circulating bills or pamphlets on company property without permission.
		6. If you forget your badge some morning, and you are half way to work, you must go back and get it, even if it means that you will be late.
		7. If you are absent the Wednesday before and the Friday following Thanksgiving, even if you are sick, you will not receive pay for Thanksgiving.
		8. If you are called to Jury duty, the Company will pay the difference between your Jury pay and your regular pay (not including overtime) up to 20 days.
		9. Contributions under the Buck of the Month Club at Lockheed go to the Red Cross and Community Chest only.
		10. You must not move a piece of equipment or furniture with a Lockheed tag on it from one department to another department without a FIXED ASSET TRANSFER form, even if it is in the same building.
		11. Part of your job as a member of the Maintenance Department is to notify your leadman or supervisor of any apparatus, machine or equipment, or building & grounds fixture, that you see is in need of repair.
		12. The most common reason why people give out classified information to unauthorized people is because of their desire to feel important.

About the Author

Wes Cooley is in his 10th year with Lockheed Aircraft. Following receipt of his Master's degree in Mechanical Engineering from Harvard University Wes eventually wound up with Lockheed's Plant Engineering Department. Here he is currently in charge of maintenance at all four Lockheed Missile Systems Division plants in the Bay Area. He started with Lockheed as an estimator and worked through the positions of Utilities Coordinator and Field Engineer on Construction.

He was a major in U. S. Army Intelligence Reserves, is a member of the Harvard Engineering Society and of the National Management Society.

The Psychology of "Selling Maintenance"

Their minds must be open to receive these ideas and to put them into practice.

A really good supervisor or manager knows that the best way to get these new ideas, new methods or systems across to the employees is to *let them suggest* the ideas. This can be done in several ways.

If the idea is yours, at a meeting of your leadmen you can, by a careful manipulation of the conversation, lead the discussion to the idea you have in mind, and *almost* present it. Invariably, one of your leadmen will pop up with the idea. If the method or idea you wish to try is in a printed publication, circulate it to the leadmen with the suggestion that they look through the publication for ideas.

Even more important, if you have a certain area or system in your department that you know could be improved upon, but you yourself have no idea how, tell your men that you know this area or system could be improved, and ask them for help in improving it. Remember, human beings naturally resent changes unless they think of them themselves.

Good Working Conditions—For good morale among your employees, their working conditions must be of the best. The maintenance shops must be clean, airy, well lighted and neat. Although many managers will say that this is impossible because of the area allocated to them, it is not impossible. The writer knows of one small maintenance group that works out of a large packing crate. This crate, approximately 15 feet by 15 feet by 12 feet high is their only shelter. These men have kept this area immaculate. It is freshly painted, the shelves are neatly kept, and everything is in place. The benches are clean and uncluttered and the men are proud of their "Maintenance Building."

Good working conditions can be had in any area, if it is kept clean, neat, and if it is freshly painted, well-lighted, and well ventilated. Beside the above conditions, the shop must be a safe shop. Safety in maintenance shops is a must for good morale.

Trouble-Free Minds—Employees, to keep their morale up, must have trouble-free minds. When you notice that one of your employees seems to be acting differently, or seems to be troubled, that is the time you should call him in and try to get to the bottom of his troubles.

Little annoyances left on his mind can grow to be big ones. Perhaps he feels that his leadman is being unfair to him. Perhaps he feels that he's "getting all the dirty work," or maybe he doesn't like the fellow he's working with. All these things affect his work. All employees work best if nothing is troubling them. It's up to you to see that their troubles are eliminated, or minimized, if possible. Idealistic though it may sound, a lot of good can be accomplished by simply sitting down with an employee and urging him to let you know what's bothering him. Some will never tell you, others will resent your prying. But, once you get a reputation for helping your employees when they have troubled minds, your job will be easier.

Esprit de Corps—Just about everything mentioned above is easier if your men have *esprit de corps*, or teamwork spirit, the feeling of working together for a common cause. If you and your supervisors lead your men, are fair and honest with them, and if they trust you, this spirit is not hard to build up. There are many methods to build up this *esprit de corps*, some of which will be mentioned later, but all of them are futile unless you show that you have the spirit, that you are proud of them, respect them, and are proud of your department.

Now that we have discussed these eight essentials to good employee morale, let us discuss some of the tools you can use to build up this morale and thereby sell maintenance to your employees. Some of these tools have already been discussed, such as the initial orientation meeting for new employees. The other tools that we will list will also aid you in promoting the aforementioned essentials to good employee morale.

Safety Meetings—At least once a month, take time to call all your employees in to a safety meeting. If they feel you are concerned for their safety, they will appreciate it, and will respond accordingly. Give them a little quiz, like the one in Fig. 5, to start them thinking about safety. Tell a joke about safety if you can dig one up. Impress them with the concern your company and management have for their safety.

Fig. 6. Cloth identification and "grading" insignia, in company with uniforms, increases pride in department and in rank held by the employee

LOCKHEED AIRCRAFT CORPORATION
MISSILE SYSTEMS DIVISION
SUNNYVALE, CALIFORNIA

GOOD HOUSEKEEPING AND SAFETY INSPECTION RATING SHEET

MAINTENANCE

Area _____ Supervisor _____ Date _____

Possible Total No. of Points _____ Total No. of Points This Inspection _____

PLANT ORDER & CLEANLINESS
(Cluttered, out of place, unnecessary, dirty, defaced, greasy)

1. Floors, aisles, storage space? _____
2. Trucks, trailers, conveyors? _____
3. Desks, files, Leadmen's areas? _____
4. Corners, out-of-way places? _____
5. Machines, materials & equipment _____
6. Work places, tables, benches, including drawers & cupboards? _____
7. Tool & supply cupboards or containers? _____
8. Tool cribs or stock cribs? _____
9. Lockers - personal? _____
10. Walls & Partitions? _____
11. All yard areas that are not assigned to depts.? _____
12. All scrap & rubbish removed? _____
13. No. of scrap containers sufficient? _____
14. Correct type of containers? _____
15. Scrap containers correctly identified? _____
16. No rubbish in scrap containers? _____
17. _____ _____
18. _____ _____
19. _____ _____
20. _____ _____
21. _____ _____
22. _____ _____

Committee Member
CHAIRMAN _____

Committee Member _____
Committee Member _____
Committee Member _____
Committee Member _____
Committee Member _____
Committee Member _____
Committee Member _____

SAFETY

1. Eye protection worn by personnel? _____
2. Gloves, aprons or other protective apparel worn where required _____
3. Safety devices all operating? _____
4. Machine guards all in place? _____
5. Loading or piling of pallets, mercuries safe? _____
6. Loading & stocking of stock shelves, storage bins safe? _____
7. Position or posture in lifting proper? _____
8. Secure & safe grip in lifting materials? _____
9. Assistance obtained in heavy lifting, or moving objects? _____
10. No working on moving or dangerous equipment (Oiling, testing, cleaning, etc.? _____
11. No use of air hose to clean clothing or benches? _____
12. Walking only in plant? _____
13. No use of makeshift equipment (a wrench for a hammer, etc.?) _____
14. No use of worn or faulty electrical cords and air hoses? _____
15. No floor hazards, hoses, doors, outlets, etc.? _____
16. Proper use of safety cans for paints & thinners? _____
17. Proper disposal of soiled rags in proper container? _____
18. _____ _____
19. _____ _____
20. _____ _____
21. _____ _____
22. _____ _____

Rating: 5 - Perfect
4 - Excellent
3 - Good
2 - Fair
1 - Poor
0 - Very Poor

Fig. 7. Check list of housekeeping and safety details is carried by committees to report on condition of various departments. When put in hand of employee committees better results are obtained than when they are management-run

Discuss recent accidents, or near-accidents, and ask how they might have been averted. Ask if any employees have seen any unsafe items or practices in their work, and promote discussions about safe practices. Urge them to use safety shoes and safety glasses, and point out the dangers of unsafe practices in terms of loss of limb or life and effects on their families.

Leadman or Foreman Meetings—Once a week, preferably, schedule a meeting of all your leadmen or foremen. Have your supervisors present also, but conduct the meeting yourself. These meetings are invaluable if you let the leadmen carry the meetings with you acting merely as a moderator. They give you an opportunity to discuss what is coming up in the future for the department, and what has been accomplished in the past.

Should you wish to correct any action or trend on the part of your employees, this is the time to do it. Point out, first, what you are pleased with about the current operating practices, then discuss what you are displeased with, or what needs improvement, and ask for suggestions for improvement in this area, and end the discussion with a re-emphasis of the operating practices that please you and satisfy you.

Committees—Every maintenance department should have a Safety Committee and a Housekeeping Committee. Small departments may have to combine the two into one committee, for economy's sake. These committees should take tours of the departmental areas every two weeks, and should be instructed to write up every violation of good housekepeing or safe practice rules that they find. One example of a check sheet is shown in Fig. 7. You will find that your shop will stay neat, clean and safe almost without any effort on your part. Your two committees will see to this. These committees should be rotated among the employees so that every employee gets a chance to serve on at least one. Don't exclude any craft from these committees.

Handouts—Show your employees that you are interested in helping them to improve their efficiency, skill and job knowledge by reproducing and handing out any charts, graphs, tables, or other data that you may run across in your readings or through contacts with vendors. Furnish each of your craftsmen with a loose-leaf notebook in which to keep these handouts.

Promotion of Personal Neatness—All employees have more pride in their work and department if they feel that they and their fellow employees are the best dressed in the company. It is your job to instill this pride in your men. Although it is impractical to furnish work clothes for all your employees, arrangements can usually be made through your purchasing department to provide distinctive work clothes at a substantial savings, based on volume purchase.

Classification Recognition—Following right in line with distinctive work clothes, arrange through your purchasing department to procure small clothes tabs to be sewn onto the employees work shirts, identifying his classification as shown in Fig. 6. These can be given to all employees at low cost. They will be proud to wear them, once you explain their purpose.

Achievement Recognition—Last, but extremely important, always recognize achievements of your employees. Most companies have printed "Commendation Notices" to commend employees for noteworthy achievements, such as good attendance records, time saving ideas, job improvements, etc. Too often these notices are rarely used. Take advantage of them. **End**

We asked these leading plant engineers:

"What's the major plant engineering or maintenance problem in industry today?"

"What is your suggested solution to this problem?"

The Number 1 Headache—

Finding, Training Maintenance Men

Better Trained Men Needed for Today's Complex Technology

Says J. B. Parchman
Plant Engineer
Texas Instruments, Inc.
Dallas, Texas

AUTOMATION WILL probably influence the plant engineer's position in industry more than anything we know of today. Automation has many definitions, but basically it is a new approach to improving the economics of manufacturing or producing more with less effort.

The maintenance of manpowered machines was entirely mechanical. Mechanically powered machines required men familiar with motors and controls. Then the machines began to use hydraulics, air power, electricity, and now electronics and instrumentation. The availability of low cost highly reliable transistors will make more automatic functions economically possible.

Unless this maintenance is properly organized and supervised, its high costs can poison the automated plant.

Automation will affect almost all parts of an organization. Management functions will change. Errors in judgment and wrong decisions will be more costly. Sufficient technical training at all levels will be required to understand the problems. Training programs including brushing up at colleges, conferences, seminars, etc., should assist present management people in developing the necessary skills and judgment. Proper training and instructions can provide most of the present production workers with enough technical know-how to fill the new jobs. Those who are not capable of being trained will have to be used in auxiliary jobs, transferred or pensioned due to their lack of skill or ability to attain them.

Machines cannot manage themselves and the ratio of management to production workers will be higher. In turn there will be a higher ratio of maintenance people to production workers.

The roof isn't going to fall in overnight, however, because there is a long line of limit switches to slow down the automation stampede. These include the high initial investment, the lack of engineering talent to design and install the equipment, a lack of skilled maintenance people, and last, but not least, the trepidation on the part of management to make an expensive change with such major influence on the entire company.

Handyman Can't Adequately Service Industrial Equipment

Says E. N. Potter
Plant Engineer
International Harvester Co.
Milwaukee, Wisconsin

IT IS MY opinion that the major plant engineering problem today is obtaining and maintaining a staff of well-trained craftsmen and supervisors to perform and direct maintenance. Because of the technological strides made in electronics, hydraulics and mechanization in the past few decades, the handyman can no longer adequately service the industrial equipment.

Most plant engineers will tell you that good maintenance men are as "scarce as hen's teeth." This probably is due to the fact that during World War II, and since that period, very few young men were interested in apprenticeship training.

Since the early 1900's we have had an indentured apprenticeship training program at the Milwaukee Works of International Harvester Company. Today we have 16 apprentices in the Maintenance Division. Their training course covers a four-year period, or 8,000 hours—7,200 of which are devoted to practical work and the remainder to classroom study. These apprentices are also encouraged to take studies in related courses at the local universities.

We realize that we will lose some of these trained men to other industries, but by training the maximum number permitted by labor contract we hope to gradually staff our maintenance division with well-trained men.

Our maintenance supervisors are also encouraged to pursue further education. At the present time we have one supervisor enrolled in the day courses at a local University studying Mechanical Engineering. We will shortly have another supervisor in the same school studying Electrical Engineering. Other maintenance foremen are participating in night school studies in their respective crafts. From time to time we send supervisory men to plants outside the Company for special training in some particular field.

I believe the greatest asset an industrial plant can have today is a well-trained maintenance force with prospective candidates among this group for supervisory positions.

Our Biggest Problem— Developing Skilled People

Says D. E. Hartquist
Plant Engineer
A. O. Smith Corp.
Kankakee, Ill.

WITH THE continuing rising costs of materials and labor which affect the ultimate market price of any manufactured product and with the simultaneous hotter competitive race for the consumer's business, industry's only out is to find, as the A. O. Smith slogan states, "A Better Way." A large share of this responsibility must be shouldered by Plant Engineering and Maintenance.

To achieve and maintain this competitive position we must take advantage of the technological advances in mechanization and automation as applied to fabricating, processing, assembly, and material handling. Our biggest problem has been and probably always will be the development of skilled people to plan, design, install, and maintain these advanced manufacturing tools. The mechanics and controls of this equipment, by the very nature of its complexity, demand more experienced engineers and maintenance people.

Experience shows that this mechanization trend is most always connected to higher production levels and line operations. Elimination of downtime of all kinds is increasingly important for overall efficiency; more emphasis must be placed on preventive maintenance.

Development and training of more engineers to be placed closer to the manufacturing operations as production engineers is part of the solution. In addition, special technical training for maintenance personnel to increase the proficiency of trouble shooting, repairing, and maintaining new automated equipment is a requirement.

Consider the Human Element In Plant Engineering

Says W. Nagel
Plant Engineer
The Lionel Corp.
New York, N. Y.

MAINTENANCE, in the past considered the stepchild of industry, suffered accordingly and eventually so did industry. With an increase in automation, the requirements for skilled maintenance workers has increased, while the ranks of production workers has decreased. This situation has led to a better recognition of maintenance by management.

Industry's biggest problem is the human element, not the tools with which industry performs our present day miracles. One solution is to provide the necessary skilled craftsmen in the numbers needed by our rapidly expanding economy. To do so, industry must make every effort toward providing incentives that will attract suitable personnel, eager to learn, so that they can be developed to follow economical production schedules.

This can be accomplished by various means: eliminate the inept and the maladjusted through the use of psychological and aptitude tests; train on-the-job or in a regular apprenticeship program. Both of these to include practical work plus theoretical classroom instruction, such instruction to be taken by the individuals on their own time in a recognized vocational school or on the plant premises. A program such as this will assure industry the pool of skilled workers so vitally necessary in today's economy and tomorrow's program.

The Era of the Wrench Mechanic Has Ended

Says K. N. Banthin
Supervisor, Const. Maint.
Visking Co.,
Div. Union Carbide Corp.
Chicago, Ill.

TRAINING AND development of personnel to secure effective preventive service and repair to our continuous and automated production facilities is one of the major problems of our maintenance program in industry today.

The era of the hammer, screw driver, and wrench mechanic has ended. The need for a mechanic with great brawn and stamina has been relinquished to material handling equipment and power tools.

To meet with the increased responsibilities of automation the following qualities must be developed in maintenance personnel:

a. An analytical perspective.
b. A pride in accomplishment.
c. Ability to read and understand instructions, diagrams and procedures.
d. Understanding and practice of the principles and specific concepts of safety.
e. Application and use of specialized tools and equipment.
f. Specialized training.

Growth and training of our maintenance organization has paralleled our development and installation of more automated facilities. Our maintenance personnel has been exposed, enthused, and trained to coincide with this expansion by the use of the following:

1. The development of a personal pride of accomplishment.
2. The instillment of an enthusiastic desire to produce a superior product at the lowest cost.
3. Prompt attention to review and settlement of personal problems.
4. In-plant training classes in mathematics and blueprint reading.
5. Active participation in an effective safety program, through weekly meetings of each foreman and his mechanics.
6. Attendance at specialized schools or training course under an Educational Grant Program (tuition and books at company expense).
7. Encouragement to make improvements through a suggestion system that pays off in cash awards.
8. Review of new designs and installation by maintenance personnel to incorporate any additions or corrections.
9. Attendance of selected mechanics at suppliers' specialized training institutes at company expense.
10. Attendance of selected personnel to special meetings.
11. Development of detail procedures for operation

or repair of specific equipment (written by maintenance supervisors).

12. Review and use of equipment manufacturers' representatives and literature.
13. Review of trade publications by maintenance supervisors under a prescribed program, with pass-along to an open shop display.
14. Specific on-the-job training of mechanics by sales representatives or supervisors (new shop equipment — initial maintenance of new production equipment).
15. Review and discussion in regular supervisory meetings or new shop and production equipment on specific safety and maintenance problems.

The Human Equation Must Be Examined

Says G. A. Heinze
Building Superintendent
Aldens, Inc.
Chicago, Ill.

EVERY STORY has three sides—yours, mine, and the facts. In the present-day world, you hear and read "Prices going up; inflation is here; manpower shortage; we're not training enough engineers."

The fact is that we must become mature and see our role in industry and government as that of a skilled helper rather than that of a director or a dominator.

As a helper, you will practice better self-control and be more tolerant of the frustrations and irritations which are the lot of the supervisor. Because he has a much broader and more sensitive grasp of the total human situation, he is not beset by the inadequacy which motivates the immature power-seeker.

This is the problem and fact which I believe should be the concern of all of us—total human situation.

The solution to the problem may sound a bit unrealistic, but let me assure you that it will work.

A leader should be only a few paces behind the group he is helping. He should not be so far ahead of the thinking of the group that they can't catch up. His real value to the organization is to prepare, encourage and inspire his people so that they will keep ahead of him in ideas and action. If you have trained a group to think; if you have kept your communications open; if you have developed in the group an understanding of management's objectives, you will have no fear of their going off in the wrong direction. You will have solved the total human situation with the highest rated morale group in the entire plant.

2. Reducing Maintenance Costs Is Painful, Too

Cost Reduction Should Be a Work Habit

Says W. A. Sorenson
Plant Engineer
Beloit Iron Works
Beloit, Wis.

THE MAJOR plant engineering and maintenance problem today is that of cost reduction.

To solve this problem we must work closely with production supervision in order to provide adequate services to efficiently operate and maintain plant facilities. We have to be a member of the team. We have to work closely with production schedules, keeping our own schedules flexible, in order to take full advantage of machine, departmental and plant fluctuations.

Future maintenance should be the foremost problem in planning new facilities and rearranging of existing areas and equipment, in order to build in maintenance cost reduction wherever possible.

Cost reduction should become a work habit with plant engineers rather than a program or one-shot campaign.

Use Check List for Providing Services at the Least Cost

Says J. G. Armstead
Resident Supervisor
F. C. Huyck & Sons
Branch Plant
Greenville, Tenn.

BEING OF New England "Yankee" heritage I answer a question by asking another. Why emphasize today? Is our problem substantially different today than it was yesterday, or probably will be tomorrow?

Is not our overall problem that of producing the required engineering and maintenance services at the least cost? For any one of us in particular the details of a solution to least cost may vary.

The following suggestions are offered as a check list to help orient your thinking.

1. Consider savings that may be possible from improved inventory control such as; standardization; quantity purchasing for lower unit cost; competitive pricing, or substitution of less expensive but sufficiently good quality materials; or balancing labor against material costs in reviewing centralized versus decentralized stores.
2. Improve labor effectiveness thru analysis of methods and installation of labor saving equipment.
3. If you do not specify job details, look for cases where pride of craftsmanship leads your men into providing better quality than required.
4. Improve labor effectiveness thru work measurement studies followed by some means of continuous control

or periodic check measurements to evaluate your gains.

5. Improve labor effectiveness thru training programs.

6. Survey completed work orders to find plant units requiring frequent maintenance which can be reduced.

7. Take a careful look at liaison between various units of your department.

8. Consider establishing labor and material budgets for each lower echelon supervisor.

9. Conduct "brainstorming" sessions with first line supervisors.

10. Survey systems you have previously installed. Determine their effectiveness and whether they are returning more in savings than their cost.

The basic problem today is the same as it was yesterday and likely will be tomorrow. Repeatedly observe all areas of expense, to continue to produce more for less.

Control of Repair Parts Helps Reduce Maintenance Costs

Says S. A. Simonson
Plant Engineer
The Chicago Hardware Foundry Co.
North Chicago, Ill.

THE MAIN object of the plant engineer is to find ways and means to reduce maintenance costs. This is getting more difficult because of the increasingly large number of completely automatic machines being used in industry today.

The control of repair parts and other materials needed to properly maintain production equipment is very important. By carefully checking each parts requisition and maintaining a close control of this material, a considerable saving can be effected.

Accurate control of all parts is obtained by tagging the parts when received. These tags contain all the pertinent data necessary to identify the part, as well as re-ordering information.

We have also tried to standardize on our equipment and in some cases made physical changes in equipment so that one item coud be used on several different machines. Parts that fit several different machines have yellow tags and are charged into an inventory account and charged out as used. Parts that fit only one machine are charged directly to that machine when ordered and get a green tag when received.

The extra effort expended by our maintenance personnel to gain this control has resulted in a 25 per cent reduction in spare parts costs this past year.

These Cost Reduction Areas Should Be Investigated

Says H. M. Eversz
Plant Engineer
McCulloch Motors Corp.
Los Angeles, Calif.

PLANT ENGINEERING IN its present concept has come a long way in improving its position in the management picture, upgrading its trades-people, and perfecting the mechanics of maintenance functions. Now we are faced with a new challenge, that of proving and improving ourselves as managers of the functions with which we are charged., The one problem that has the greatest urgency is cost reduction in its larger sense.

First, let us review our organization. Do we have qualified people to intelligently analyze all of the projects and requests presented to us, and are they searching for the most economical solution or just taking the first and easiest course that comes to mind? On the other hand have we loaded on too many staff people, thinking that sheer numbers can provide an adequate job of problem coverage? Do we have real and productive scheduling of our work force? What percentage of available labor hours are actually scheduled? What about parts and supplies inventory?

The matter of preventive maintenance has been placed in the second or operative side of this discussion because we feel that while it is of great value in reducing maintenance expenditures its greatest asset is in continued production. Do we have such a preventive maintenance program and is it really productive or is it tied up in inspections, reports and red tape?

One further area to be closely watched for hidden dollars are utilities. Are we sure that our air, light and power, water, gas and communication systems are not stealing profit dollars.

When we have faced up to each of these questions and are sure that action is being taken in every case then we are on our way to real cost reduction.

Search for Ways To Improve Efficiency

Says D. R. McLeish
Manager, Engineering Maintenance Depts.
Eli Lilly and Co.
Indianapolis, Ind.

ALTHOUGH THERE are many individual problems in the course of our various activities, almost always these problems involve the constant search for ways to improve our efficiency and thus get more for the dollars spent.

A well planned maintenance program is the first essential. This can best be prepared by engineers who understand how, when, and why maintenance must be done.

Budgets are a necessary part of any operation. Maintenance engineers should be assigned the responsibility for preparing and carrying out the budgets necessary for the maintenance of buildings, utilities, equipment, and services.

A program, no matter how skillfully prepared or scientifically correct, will not be successful unless maintenance workers understand the program and desire to make it work.

We can measure to a great extent the soundness of our maintenance program by maintaining and examining our cost and descriptive records; and by continuous review, are in a position to adjust to the indicated needs.

Maintenance engineers have a responsibility to design engineering groups to make recommendations based upon studies, maintenance data, and experiences which will result in the fabrication or procurement of equipment, materials, buildings, and services with lower main-

tenance costs and more satisfactory operating conditions.

We feel we have made many improvements in maintenance cost reduction. However, continuous study and close scrutiny of our constantly changing programs are necessary to insure increasing success in obtaining more for our maintenance dollars.

3. Establishing a PM Program

Difficulty in Inaugurating PM Program

Says R. L. Crawford
Plant Engineer
Fulton Bag & Cotton Mills
Atlanta, Ga.

SEVERAL VOLUMES could be written on the subject of program maintenance and of the advantages that are to be derived from the successful installation of such a system. It was a major inaugurating problem for us.

Production men argued that the machine time was vital, that they could not lose the time such a program required. Since it was a five day operation, why couldn't the machines be inspected on Saturdays? There are several rebuttals to this thought. In the first place, there are too many units to maintain and the inspection frequency would be too long. Addition of men to the maintenance payroll is uneconomical for a one or two day load; a swing shift would mean that during the week days we would have either more or less men than we actually needed. The optimum labor load can only be attained with a balanced work load.

Scheduled maintenance makes for a generally smoother operation. Work crews are lined up in advance and can be on the job at the start of the day with the necessary materials (as determined by the last inspection) already at the site.

PM Programs Need Improvement

Says M. M. Wilson
Plant Engineer
Townsend Company
New Brighton, Pa.

PROBLEM: Preventive Maintenance To Minimize Operating Down Time. From my own experience I would say the major plant engineering problem in industry today is the need to improve preventive maintenance programs.

PROPOSED SOLUTION: In-Plant Rebuilding Program and Maintenance Scheduling.

Two major steps are being taken in our plant toward the establishment of preventive maintenance.

The first step is an in-plant equipment rebuilding program. We have formerly had most of our general overhaul jobs on our production equipment performed by outside job shops. We felt that this work should be performed by our own maintenance department.

To be able to do this, we needed extra machine tools in the maintenance department. We were able to obtain the money for these machine tools without increasing the annual budget, by selling our production superintendents and our top management on the advisability of substituting this program for some of the outside repair work scheduled for this year.

The second step is the establishment of a maintenance scheduling system.

Use of a written work order for all maintenance work is stressed. Estimated man hours for each craft is compiled for each work order.

This gives a realistic work backlog picture for each craft. Actual completion times compared to the estimated times furnish data for the evaluation of performance.

4. And, Some Specialized Problems

Providing Equipment for Special Environmental Conditions

Says G. Schlobach
Plant Engineer
IBM
Poughkeepsie, New York

THE REQUIREMENTS for equipment to maintain special environmental conditions, plus the installation and maintenance of specialized production equipment, is the type of situation that poses one of the major problems of our plant engineering personnel today.

Three undesirable conditions are generated:

1. In an effort to meet new conditions, our engineers have a tendency to overdesign our installations.

By the same token, underdesign is expensive. In many cases, manufacturing does not know exactly what conditions must be maintained in order to produce a new product, and environmental conditions specified for a new manufacturing process had to be revised as experience was gained.

2. Installation of equipment necessary to maintain these environmental conditions, plus the installation of special production equipment, causes a loss of rearrangement flexibility.

3. The last condition is the need for educational courses

for our plant engineering and maintenance personnel.

As for a solution to our problem, we feel that we must make an honest effort to create an understanding between Plant Engineering and Manufacturing, so that manufacturing facilities are economical, as flexible as possible, easily maintained, yet provide service.

In an attempt to create this understanding, we have:

1. Taken manufacturing personnel on tours of our service installations, pointing out some of our more common problems in these areas.
2. Fostered exchange of ideas in the early planning stages of these manufacturing installations, with the idea in mind of covering anticipated situations that may develop, to prevent an appreciable amount of overdesign.
3. Insisted on good, long range space planning.
4. Scheduled as many educational courses as practical.

Modernizing Present Facilities To Improve Operations

Says J. Paul Jordan
Director of Engineering
Dodge Manufacturing Corp.
Mishawaka, Indiana

ONE OF OUR major plant engineering projects has been building maintenance and modernization.

We recognize that anything other than ground floor areas are not desirable for manufacturing purposes and have thus restricted all new buildings to a single story.

Some second floor areas that were located convenient to our existing offices have been converted to office space. We were able to eliminate part of the columns by using open web steel joists. Where it was not practical to remove the columns, they were replaced with four-inch steel pipe. The walls were furred out and plastered. Windows were replaced and a suspended ceiling was installed.

For many years our Pattern Shop was located on the second floor over our Core Room. Two years ago we constructed a new Pattern Shop adjacent to the Core Room. After moving the pattern-making activities to the new location, we applied roofing to the second floor of the old building and constructed a new roof slightly above the old floor. The old floor made excellent staging for this construction work. This roof spanned 50 ft.

To cite an 'incidental' problem, we found some of the floors to be as much as three inches low in spots. After applying a vapor barrier, the floors were leveled with cement and an mica pellet aggregate, then covered with $\frac{5}{8}$-in. plywood and a resilient tile floor.

Better Maintenance Measuring Devices Needed

Says P. G. Damm
Chief Plant Engineer
Merck Sharp & Dohme
Div. of Merck & Co., Inc.
Philadelphia, Pa.

THE MAJOR plant engineering problem for industry today is the need for better measuring devices. Not in the sense of physical tools, but in measuring labor requirements, equipment requirements, and in general what maintenance costs should be. The plant engineer is constantly faced with the problem of how much maintenance should cost, how many men should be required, and how much equipment is needed to do the work. On what basis can this be measured?

While not a solution to the problem, I would like to offer the following suggestions:

1. Measured Maintenance Work—This can be work sampling, standard times or historic data.
2. Expand Preventive Maintenance to reduce emergency work. A preventive maintenance program to include all items in a plant would be required, and it could easily be tied into the measured maintenance plan.

After having a few years experience with the expanded program, accurate data could be compiled to:

(a) determine frequency of maintenance required
(b) determine effect production has on equipment with regard to frequencies of maintenance
(c) determine emergency work still required
(d) determine approximate amount of other than maintenance work for estimating manpower and equipment required.

Too many of our plant groups are continually 'putting out fires' and never really accomplishing the planned and preventive side of maintenance.

Industrial Growth Presents Problems for Plant Engineers

Says Max Ryen
P'ant Engineer
Metals Processing Div.
Curtiss-Wright Corp.
Buffalo, N. Y.

RECENT STRIDES toward better living are having their effect on industry. We think that industry has a much broader problem than ever before and it is growing daily.

The problem is to arrange and install production machines and equipment, which contaminate the plant internally, in the proper sequence for production operations with suitable working conditions which meet municipal and state regulations governing the control of these contaminants in and out of the plant, at reasonable expense.

We think that machinery having excessive noises and vibration should be housed together in a room that is well insulated and ventilated.

Smoke nuisances created by melting and heating equipment, drying and baking equipment, give off soot, fly ash, and odors. Improved fuels and combustion will reduce the soot. Where fly ash is present and odors prevail, it is necessary to install washing equipment.

Fumes emanating from paint spraying, acid baths, chemical plants, rendering plants can be treated in the same manner as smoke.

Heat in the plant caused by furnaces, drying and baking, and the weather should be controlled with more and better insulation, quick acting doors on the equipment, automatic temperature controls, and exhaust.

Sewage, other than sanitary, containing acid from plating systems, descaling systems, chemical plants, etc., must be treated before disposal.

An ever growing, better educated population demands better living. Industry must meet this challenge.

Practical and technical know-how is required to qualify for this purpose; the plant engineer and his associates are best equipped to assume this assignment. **End**

Change in Janitorial System Pays Dividends

By F. N. **BRAATHEN**, General Maintenance Foreman, Union Special Machine Co., Chicago, Ill.

DRAWBACKS INHERENT in the post assignment plan wherein one man is responsible for all the necessary work in a particular area had plagued us for some time. We have two multi-story buildings in Chicago, one with seven stories, and one with five. Sixty per cent of the space is for plant use, and the remainder consists of offices, locker rooms, cafeteria, and storage. With such facilities the janitorial duties under the plan mentioned can be varied and complex.

As an illustration, consider, if you will, the duties that were assigned to our 6th floor janitor: 1. Sweep 2,000 sq ft of space daily. 2. Pick up paper and rubbish. 3. Clean drinking fountains. 4. Sweep three stairwells down to the fifth floor. 5. Clean washroom sinks. 6. Mop washroom floor. 7. Empty paper towel containers. 8. Replenish toilet room supplies. 9. Clean goggle cleaner dispensers. 10. Clean light fixtures. 11. Clean blinds. 12. Clean toilet room walls.

It can be deduced from the above, that a large number of tools and supply items were needed to perform the listed tasks, each of which required storage space. Since we had 12 janitors, we had a similar number of lockers, each of which held tools and supplies of all types.

For every supply item ordered, a requisition ticket had to be issued, resulting in much time being spent by maintenance supervision and inventory clerks in requisitioning and processing tickets.

In order to pick up waste paper, each janitor required a truck which he filled and brought down to the baling area. Time was lost waiting for elevators and was consumed in the storage of trucks.

In January of 1957, the post assignment plan was abandoned and the group cleaning system was placed in operation. We assigned specific tasks as follows: 1. A group of four men to sweep the floors throughout the plant and offices daily, from the top floor through the basement in both buildings.

2. One man to pick up paper throughout the plant, truck it to the baling machine, bale it, and transport the bales to the shipping dock.

3. One man to replenish toilet room supplies. (This man was given a truck designed to hold paper towels, powder and liquid soaps, and so forth. The truck was made to fit through entrance doors, and aisles along the man's route. Sufficient containers were placed in the washrooms in order that supplies needed to be replenished only once daily.

4. A man to clean wash fountains, sinks, goggle cleaners and water coolers throughout the plant. (This man was also provided with a truck designed for his job). See Fig. 1.

5. One man to clean venetian blinds, light fixtures and toilet room walls. (This job is done under a rotating schedule whereby the blinds, fixtures, and walls each get cleaned three times per year).

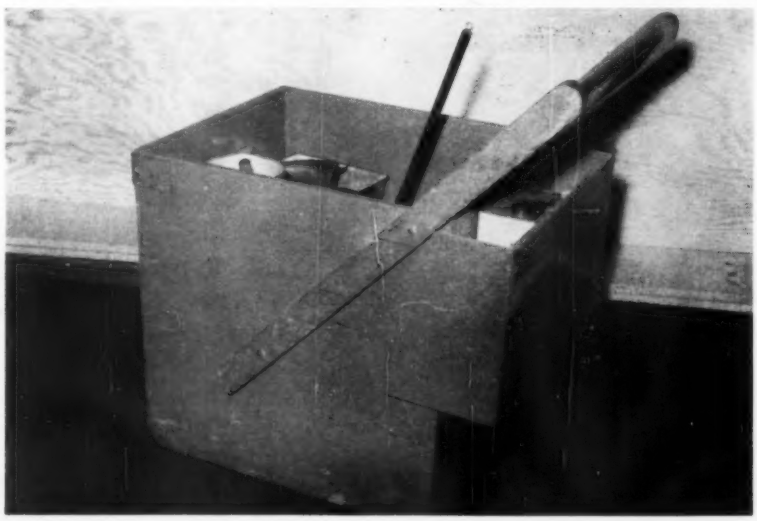
6. One man to empty and steam clean garbage cans, empty rubbish containers, and pick up assorted bulky refuse throughout the plant.

The following are some of the advantages we found inherent in the group cleaning system: 1. Sufficient time was saved to enable nine men to do the job formerly requiring twelve men. 2. Number of tools and equipment in use was reduced. For example, 12 brooms were needed under the post assignment plan, four brooms are in use under the new plan. Twelve paper storage trucks were used before, one now. Twelve sink brushes before, one now, and so on.

3. Only 9 per cent of the former number of supply requisitions are now processed. 4. No storage cabinets are needed. Floor space is saved and cluttered corners eliminated.

5. Training of new men is simple compared to the headaches encountered before in teaching new people a great variety of tasks. 6. Supervision is simplified. Each man's routine becomes established in the foreman's mind and the men can be located when needed. **End**

Fig. 1. Cart carries supplies for worker who cleans specific groups of items

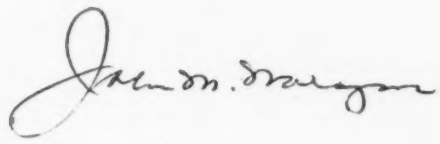


Profile: The American Plant Engineer

THE AMERICAN INSTITUTE of Plant Engineers defines plant engineers as "Those exercising supervisory charge of or executive responsibility for all or some phase of design, layout, construction, maintenance and control of facilities for plant .....". In order to audit this definition of the plant engineer, and get a better picture of the actual role he plays on the management team, AIPE's Research and Coordination Committee compiled a questionnaire which was sent to all of its members. The compilation of data from the 520 returns presents an accurate "Profile of the Plant Engineer".

The typical plant engineer is 43 years old, is a college graduate and has had about 13 years experience in this particular field. He is responsible for a plant covering over 15 acres of floor space and representing a plant investment of about fifteen million dollars. He has a big job in every sense of the word and rates as a "regular" on his management team. His broad responsibilities in the design, specification, construction and maintenance of plant facilities put him in a class with the nation's largest customers. As industry increases its investment in plant facilities with more and better and faster machines and equipment, the role of the plant engineer in management becomes increasingly important.

Our sincere thanks go to the many plant engineers and their associates who cooperated in the survey. We are particularly grateful to our past presidents, Richard H. Morris and Robert W. Hiller; our Activities Committee, B. J. Drummond, R. S. Grant and D. L. Smith for their not inconsiderable efforts in making this compilation possible. We are confident that it will provide a useful tool for plant engineers as well as to the executives in aligning responsibilities for plant engineering functions.



John M. Waligora, President, American Institute of Plant Engineers
Chief Engineer, Merck Sharp & Dohme, Division Merck & Co., Inc.

What the AIPE Survey Showed

ABOUT TWO YEARS ago the then fledgling American Institute of Plant Engineers decided it was high time to peek under the covers of its membership roster and find out just what qualities, job functions and responsibilities made the plant engineer a breed of cat different from other engineers.

They knew, of course, what his broad general responsibilities were. They knew approximately where he fits into the top management structure. What they wanted to know, however, was how many deviations there were from this generally accepted picture. Did his salary vary with his plant size? How did his salary correspond to his education? Did his geographical location affect his income or his standing management-wise?

The survey has now been completed and tabulated. On the following pages you will find the answers to these and other questions:

1. What is the high and average salary received by the 520 men who replied to the questionnaire?

2. What college or university training have these men had and how many years experience in plant-engineering work?

3. In what kind of industries is he employed and what is the total plant investment?

4. Does he have a union? Does he have maintenance cost measurement? Does he have a preventive maintenance program?

5. How big is his plant? How many square feet and how many buildings?

6. What is the area of his responsibility in buildings and grounds? In plant equipment? In plant utilities?

7. Does he deal with outside contractors? Is he in charge of fire protection and janitorial services? How about safety and plant security?

8. How about the number and type of personnel supervised? How many engineers, how many clerical, how many hourly and what crafts are represented?

The detailed report is much too bulky to reproduce on these pages. The first portion of the report summarizes the findings for the whole country and it is to this part that we will confine the article on these pages. It tells in what types of industries the plant engineers are employed; just what their operations are and what management tools they can bring to their work.

Because it is impossible for PLANT ENGINEERING to present within its pages the entire story of this, the first large scale attempt to pinpoint exactly what the plant engineer does, we are making available to our readers one copy of this report free of charge, upon letterhead request. Additional copies will be supplied by The American Institute of Plant Engineers, P. O. Box 185, Barrington, Illinois, for $1.50 each. Checks or money orders should be made payable to that organization.

In this report on the survey we shall attempt to sum up most of its salient points. A few of the detailed tables will be reproduced here to illustrate the types of findings available in the report itself.

Table I. Here are general operating characteristics of respondents' organizations

	Total Replies	No. Yes	% Yes	No. No	% No
1. Has a union	517	458	88.6	116	22.4*
CIO		216	53.7*		
AFL		191	47.5		
Other		51	10.2		
2. Has maintenance cost measurement	480	275	57.3	205	42.7
3. Has maintenance work measurement	443	127	28.7	316	71.3
4. Has preventive maintenance program	493	406	82.4	87	17.6
5. Has written maintenance control program	479	279	58.2	200	41.8
6. Has punched card maintenance records	449	69	15.4	380	84.6

*Totals more than 100 per cent because some plants had more than one union

Table II. Average, maximum and minimum figures on respondents' organizations

	Number of Replies	Maximum	Average	Minimum
1. Floor area in sq ft	419	5,800,000	670,000	10,000
2. Number of buildings	462	189	00	1
3. Number of plants (in multi-plant company	449	20	1.6	1
4. Number of employees in plant	470	36,000	1,760	10
5. Plant investment, dollars	317	300,000,000	15,300,000	150,000

Table III. Characteristics and numbers of employees in plant engineering groups

Number of Plant Engineering Personnel Supervised (Base: 100 per cent—520 respondents)	Number Supervised	Per Cent Supervised
1—Professional and semiprofessional		
Engineers	332	63.8
Draftsmen	251	48.3
Maintenance Supervisors	387	74.4
2—Administrative		
Clerical	391	75.2
Other	116	22.3
3—Hourly		
Mechanical	407	78.3
Electrical	392	75.4
Building Construction and Maintenance	321	61.7
Housekeeping	296	56.9
Other Services	234	45.0

Education: One of the important areas under investigation was the education of the respondents. Of the 519 responses to this portion of the survey 318 had earned degrees; of these 157 had degrees in mechanical engineering and 40 in electrical engineering. The remainder were divided between civil, chemical, industrial and architectural with 63 not specified.

Experience: The greatest number of years in engineering was 55; the average was 17, while the minimum was one year. Greatest number of years in plant engineering or maintenance works was 42; the average was 13 and the minimum was one year. 36 years was the maximum number of years listed by a respondent as having served as the plant engineer or in the respondent's present capacity; 8 years was the average, while one year was the minimum.

Where Does He Work? One portion of the survey investigated the type of industry in which the respondents were employed. The actual analysis was made on the basis of the Standard Industrial Classification, and it showed that Chemicals and Allied Products employed the greatest number of the respondents, 83. Second was Fabricated Metal Products with 82 respondents. Following these with 50 respondents each were Food and Kindred Products, and Transportation Equipment. SIC groups Machinery, (except Electrical), and Primary Metal Industries, were next in line with 33 and 26 respondents respectively. The rest of the respondents were divided between the remaining 15 SIC groups.

What He Does: This is probably one of the most interesting sections of the survey and for this reason we are reproducing the detailed findings in the accompanying tables. Table I presents the general operating plan of the respondents' organizations. Table II describes details of the physical plant for which they were responsible.

Shown in Table IV are the areas of work responsibility in connection with three major phases of the physical plant—1. Buildings and Grounds; 2. Plant Equipment; and 3. Utility Systems and Services. In addition Table IV investigates the plant engineer's responsibility in connection with outside contractors, fire protection, janitorial services, safety, and plant security and functions.

Table IV. This table shows numbers and percentages of plant engineers responsible for various phases of plant operations and their degree of responsibility

Areas of Responsibility (520 respondents)	Number Responsible	Per Cent Responsible
1—Buildings and Grounds		
Design	290	55.8
Specification	339	65.2
Construction	377	72.5
Maintenance	449	86.3
Layout	362	69.6
2—Plant Equipment		
Design	281	54.0
Specification	361	69.4
Installation	474	91.2
Maintenance	448	86.2
Layout	368	70.8
3—Utility Systems and Services		
Design	316	60.8
Specification	377	72.5
Construction	398	76.5
Maintenance	438	84.2
Operation	412	79.2

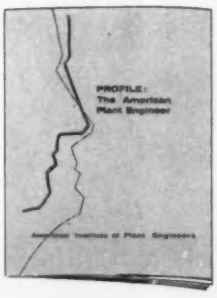
	Number Yes	Per Cent Yes	Number No	Per Cent No
4—Outside Contractors	471	90.6	30	5.8*
5—Fire Protection	354	68.1	125	24.0
6—Janitorial Services	281	54.0	191	36.7
7—Spare Parts Control	427	82.1	66	12.7
8—Safety	265	51.0	204	39.2
9—Security	194	37.3	265	51.0
10—Maintenance Labor Negotiations	157	30.2	289	55.6

*Difference between these percentage totals and 100 per cent is accounted for by fact that not all portions of this question were answered by all respondents.

What Is He Called? Another portion of the survey—not reproduced here—proves that titles are still far from being standardized. Inasmuch as the survey was conducted exclusively among members of the American Institute of Plant Engineers it is obvious that all respondents were plant engineers by function if not by title. But, 77 different titles were listed; of these 287 were called "Plant Engineers," 42 were called "Maintenance Superintendents."

There were 32 "Chief Engineers" and 27 "Assistant Plant Engineers." There were 18 "Maintenance Engineers" listed and 11 "Works Engineers." **End**

How To Get a Copy of the Complete 32-Page Report



One copy of the complete 32-page report, "Profile: The American Plant Engineer," is being made available to each Plant Engineering reader who wants one. All requests for the free copy must be made on company letterhead and addressed to The Editor, Plant Engineering. 308 E. James St., Barrington, Illinois.

Conservin' Mervin Works Free—

Saves Beech $150,000 First Year

ONE YEAR OF EMPHASIS on conservation of materials has paid off handsomely for Beech Aircraft Corporation, Wichita, Kansas. Conservation-conscious employees at Beech saved nearly $150,000 in materials from July, 1956, to July, 1957, through extra care in handling, machining and stocking of parts and equipment.

Back of the successful program has been a plant-wide education campaign under the guiding efforts of the Beech Conservation Committee, a seven-member group appointed by top Beech management. The committee members are representatives of the production, manufacturing, procurement, manufacturing engineering, quality control and engineering departments. Formed on July 1, 1956, the committee is now under its third chairmanship of six months' tenure.

The objective of the conservation committee has been to enlist the cooperation of all employees in seeking and maintaining the most economical use of materials of every kind, from office to foundry. To reach the thousands of workers concerned, the committee aimed at an important target—departmental responsibility.

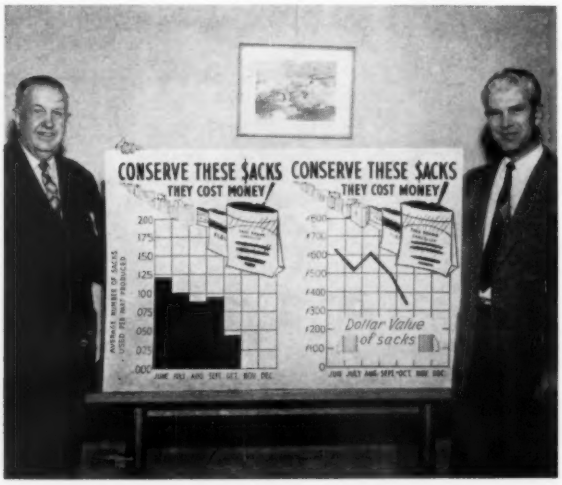
When areas in which conservation policies could be carried out are determined by the committee, the appropriate supervisory personnel are informed of the situation. This is done not only through presenting information and statistics, but also through the use of photographs which show a condition that needs to be remedied.

Once a campaign gets underway, the importance of continued conservation efforts is pointed out through the use of bulletin board announcements and reports published in the company's monthly employee magazine. Results of each conservation program are charted and given wide distribution, so that progress of the project is known to all concerned.

Areas in which the committee has instigated conservation policies are both inconspicuous and obvious. Projects undertaken have included the reallocation and substitution of stocked items, salvage of parts and

Fig. 1. Handling of titanium scrap required use of containers painted striking yellow with red band. Importance of keeping special salvage separate is explained to machine operator

Fig. 2. Paper bags are used at Beech for handling small parts. Chart, displayed around the plant, shows savings in bags and in dollars in four months of conservation campaign



equipment, and conservation in the use of such items as drill bits, titanium, wiping rags, paper bags for handling small items, masking tape and office supplies.

The wiping rags program is an example of the committee's attention to the so-called little things that tend to be overlooked in a large plant. They found excessive use due to two situations—over supply in some departments, and unsatisfactory quality of the rags.

Vivid evidence was produced in the form of photographs. Overstocked department supplies were shown. A bale of rags was broken down and photos were taken of the usable rags and those considered too small for practicable use.

Through a more strict system of procurement of the rags and more careful planning in ordering by the shops, a 76 per cent decrease in the use of wiping rags was realized.

In another instance, a four-months' long campaign resulted in a $300 a month saving in the cost of paper bags used as containers for small parts.

Conservation tactics applied to the use of one of the newest and most expensive metals in the aircraft industry—titanium—resulted in substantial savings to the company. Employees on all levels were informed of the high cost of the metal—around $20 per pound.

Salvage containers stamped "Titanium-Critical Material" were provided at all machining areas. Careful handling to avoid scratches and nicks was emphasized. The special care exercised, from production planner to machinist, added considerably to the conservation program total savings.

Washing Machine Helps Out

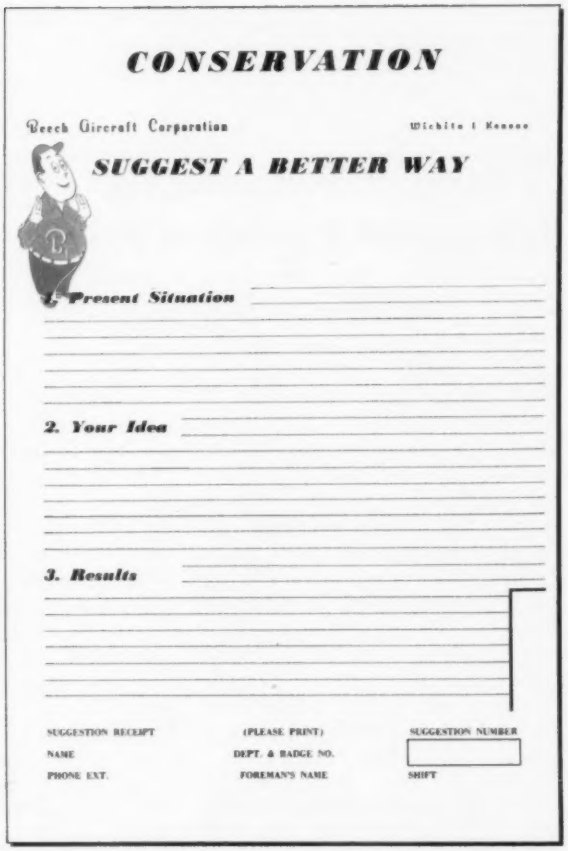
An unusual project effected by one of the conservation committee members consists of the salvaging of thousands of plastic caps which are used to protect the many pieces of tubing that go into an airplane. When removed from the tubing on final assembly, most of the caps were discarded because they were dirty or greasy. A $25 second-hand washing machine, purchased by the committeeman, now washes the caps in a cleaning solution so that they may be reused. Nearly 500,000 caps were reclaimed during the first year of the washer's use.

One of the late projects of the committee has been the restoration of damaged drills, reamers, mill cutters and router bits through a local vendor. Under the program, nearly 10,000 drills have been returned to Beech at 50 per cent of the cost of new drills.

A suggestion blank project is the latest move by the committee toward enlisting individual participation in the conservation movement. Employees' suggestions are particularly solicited, and the suggestion form is expected to uncover valuable ideas.

Beech management recently took an important step in furthering the work of the conservation committee through the assignment of a conservation administrator. With Beech for 10 years and with five years of experience in the mechanical technicians department, he will devote full time to conservation promotion and working with the committee.

The conservation committee is not resting on the success of the current program. Much greater savings are anticipated. Their goal, of course, is the complete elimination of waste. **End**


CONSERVATION

Beech Aircraft Corporation Wichita 1, Kansas

SUGGEST A BETTER WAY

1. Present Situation

2. Your Idea

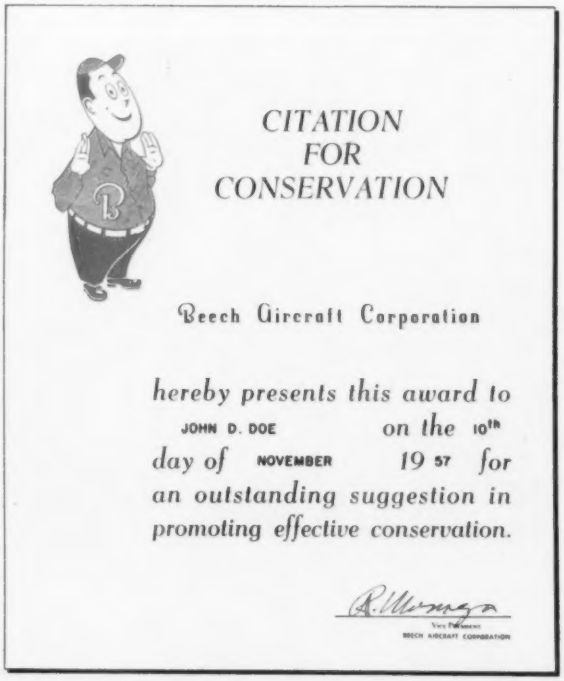
3. Results

SUGGESTION RECEIPT (PLEASE PRINT) SUGGESTION NUMBER

NAME DEPT. & BADGE NO.

PHONE EXT. FOREMAN'S NAME SHIFT

Fig. 3. Employees suggestions to improve conservation are solicited. To make it easy, this form has been provided


CITATION FOR CONSERVATION

Beech Aircraft Corporation

hereby presents this award to

JOHN D. DOE *on the* 10th

day of NOVEMBER 19 57 *for*

an outstanding suggestion in promoting effective conservation.

Fig. 4. Citation for Conservation is awarded to employees who give outstanding assistance in promoting conservation

Tough Welding Jobs Simplified

Tripod and Pendulum Setup Is Big Time Saver

By R. A. BUTLER, Plant Engineer, Struthers Wells Corporation, Titusville, Pa.

DURING THE manufacture of a large number of cylindrical pressure vessels we were able to increase production greatly by the partial utilization of "gravity" to weld automatically the closing seam on the interior of the tanks.

Tanks which were processed had only one opening, an 18-in. manway, through which a man and his welding equipment could pass to weld the closing seam either manually with stick electrodes or with a semi-automatic or a continuous welding machine (squirt type).

Since approximately 23 ft of code welding on the inside of this closing seam was required, the manual welding procedure required approximately 6 to 8 hr. Arc time was considerably less than this; because of his position in the dark, and heat and fumes created by the welding was reason enough for the operator to leave the job after short periods of time to rest. Aside from handling the welding torch, observing the arc, and manipulating of current and amperage controls through remote welding generator controls, the operator was of necessity quite engrossed in his work.

Under the circumstances, work quality would suffer resulting in excessive cut outs and re-welding parts of the seam, all of which in turn created production bottlenecks. Too, most of the process required that the weldor have a helper.

In an effort to improve on these conditions and to eliminate most of the human element, the Plant Engineering Department designed an automatic inside-welding machine first for inert gas welding the closing seam in non-ferrous tanks, and later for submerged arc welding steel tanks.

As detailed in the sketch, Fig. 1, the fixture consists simply of a tripod with all legs in a single plane. Two of these legs are fixed to suit the inside diameter of the vessel being welded and the third leg is adjustable to permit setting up the device which when tightened automatically places the fulcrum of the pendulum on or very near the center line of the vessel—depending on out of roundness of the rolled cylinder. In accordance with code requirements this irregularity never exceeds one per cent of the diameter.

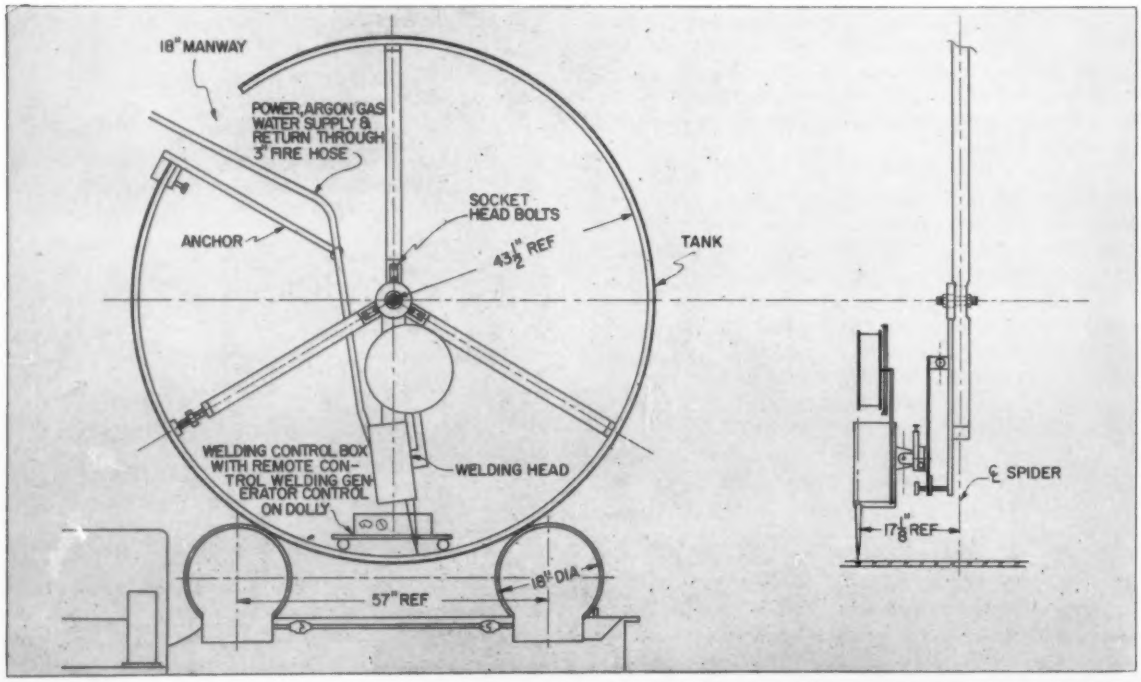


Fig. 1. Welding head assembly moves freely about center of tripod and follows welding operations as the tank rotates

Any error in this respect is compensated by means of a horizontal and vertical adjusting device through which a welding head is mounted to the pendulum.

To assist the operator in setting up the "spider" at 90 deg or normal to the horizontal center line of the vessel, the shell courses at time of layout were marked by the layout department to indicate the proper location for the spider legs to be set inside the tank. The equipment was designed to be dismantled readily and easily for inserting all its elements through the 18-in. manway and subsequently just as readily re-assembled inside the vessel.

Welding Positioners

A tank to be welded on the closing seam was set on a pair of rubber tired power and idler welding positioners, which in turn were mounted on rails imbedded in concrete. The operator set up and assembled the spider assembly near the seam to be welded, made the power, gas and water connections to the welding head and welding was ready to begin.

The control box, including the remote generator and positioner controls, was mounted on a four-wheeled dolly, convenient for the operator.

All of the welding gas, power cables and water hose were encased in a 3-in. fire hose to avoid their wear and tangling. This hose assembly was of sufficient length to permit it to wrap around the outside of the vessel one complete turn with allowance for slack as welding progressed.

Fixture setup time by one man required one-half hour at the most. With welding underway, the complete seam was welded in another half hour.

The automatic welding head at the end of the anti-friction bearing mounted pendulum always remains vertical due to gravity while the tank is rotated by the power roll at the proper welding speed. This speed is usually pre-set; a remote control push button at the operator's position permits him to start, stop or adjust the welding speed according to conditions.

Appearance and the X-ray quality of the closing seam weld improved to the extent that cut-outs immediately became nil and in one man-hr, work ordinarily requiring 12 to 16 man-hr was accomplished.

Submerged Arc Welding

Success of this automatic inside-welding device prompted the design of the same arrangement for submerged arc welding. This application produced gratifying results.

Because the expense of modifying the tripod or spider to fit larger or smaller vessels is negligible, by merely changing the length of the legs, we now use this automatic welding process on all vessels which otherwise would have to be manually welded on the inside. **End**

Resistance Heating of Metal for Die Forming

TO RESISTANCE HEAT titanium sheets to high temperature and form the metal quickly while it is still at an elevated temperature, the Martin Company, Baltimore Division, has developed a special Power Pac. The transformer in the latter has a 440 v, 60 cy, single-phase primary and a 10-20-40 v secondary.

Temperature sensing is accomplished with a Rayotube element, which can determine the temperature of the metal without coming into contact with it. The saturable reactor of the Reactrol control is connected in series with the resistance heating transformer and with a current transformer.

The reactor permits an infinitely variable control of the power transformer, while the current transformer produces a feedback signal which limits the maximum current flow through a given size of material. This special multi-tap current transformer in the feedback circuit permits a range of material sizes.

Secondary leads of the power transformer are connected to opposite ends of the titanium sheet. When the power is turned on, the titanium is resistance heated.

As the temperature of the part approaches the pre-set value, the "heat-up" power is reduced until it is low enough to maintain the heat at the desired level. The power is cut off by the operator at this point and the forming stroke is made.

The metal must have sufficient overhang of the die so that the transformer leads can be connected to it. This is accomplished by welding aluminum tabs to the detail blank in the trim area. The titanium sheet must be insulated electrically from the lower form die by coating the top of the die with a thin layer of Sauereisen (oxide of iron). If the part requires additional forming, the die is raised and the whole cycle repeated. **End**

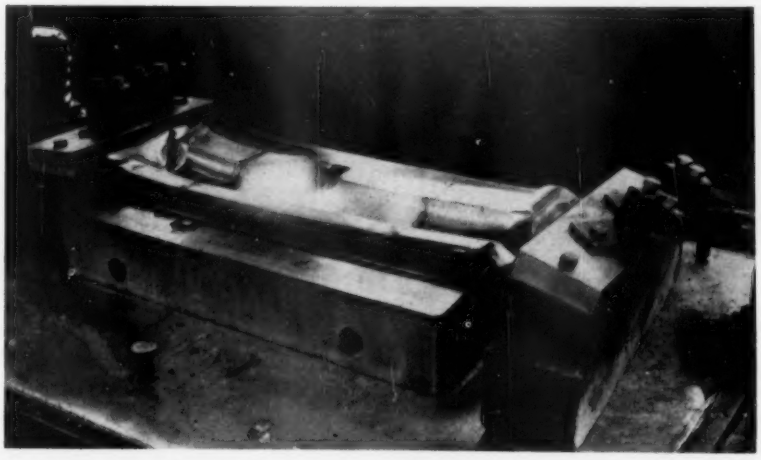


Fig. 1. The transformer leads are connected at opposite ends of the workpiece

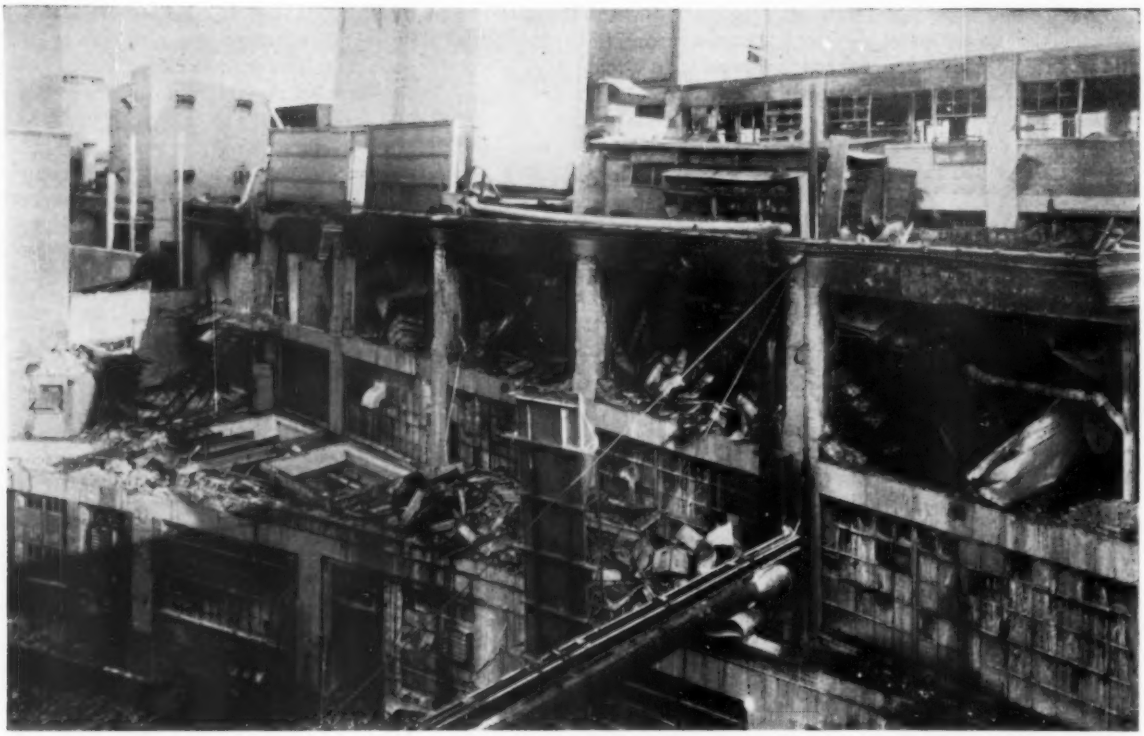


Fig. 1. Widespread destruction in this plant is aftermath of tremendous forces unleashed by ignited dust particles

Plant Explosion Hazard—Dust

Accidents, Metallic Dusts, Static Spark, and Venting

By **WILBUR G. HUDSON, Consulting Engineer, Chicago, Illinois**

DUST EXPLOSION hazard is a matter of major importance in the engineering of plant layouts and in the subsequent operations, particularly in the light of the increased use of processes involving plastics, metallic dusts and other pulverized materials.

Fifteen years ago Mr. Irving Hartman, Chief, Branch of Dust Explosions, Bureau of Mines, commented that in the previous ten years, nearly 10,000 serious dust explosions had occurred, 575 persons killed with $50 million property damage; and these figures did not include explosions in mines nor many small unreported explosions. He remarked that it was not so strange that there were so many, as it was that there were not more. Today these misfortunes are far more frequent. Consider the grim report of Mr. Clinton Dicken, V.P. of the E. J. Brach Candy Co., Chicago, on the dust explosion which destroyed part of that plant: "In the early morning, 19 cooks and machine operators reported for work between 3:30 and 3:45. They changed their clothes and reported to their work stations on the third and fourth floors. The printing and casting machines were checked and made ready for the start of operations.

"The cooks were preparing for their first batches of candy. Suddenly there was a strange noise like rushing air—then came the blast and almost simultaneously there was a sheet of flame that engulfed the area. There followed a series of explosions on the third and fourth floors which blew out windows and exterior walls, followed by a flash fire of extreme intensity which ignited starch trays, starch in these trays and cork insulation. Fortunately, because of the early hour, only 43 employes were on the premises. There were 19 in the area directly involved. Sixteen of these were badly burned. Of these, only one survived."

While the exact cause of the disaster could not be determined, or how the starch dust cloud originated, the fire marshal stated that a small fire was in progress in the area prior to the explosion; this opinion was based on the position of fire extinguishers and the fact that a handhose was found unreeled. Some of the theories were: 1. An attempt to fight a small fire

in the vicinity failed. 2. A spark from electrical equipment ignited suspended starch dust. 3. One of the employees may have been smoking.

A few months ago I visited a plant in Chicago following news reports of a dust explosion. The cause was obvious. Shavings and wood dust in this plant were blown into a centrifugal separator atop a 40 ft concrete storage bin and dropped into the bin. At floor level a four feet square opening with a steel plate slide gate was located close to the boiler to which the material was fed.

The gate had been left open. A small flame had trickled along the floor and was drawn by the up-draft into the bin. The flame was fanned until it reached up into the floating dust and an explosion followed which blew out the sides of the bin and the wall of the boiler house. Failure to recognize the risk in leaving the outlet gate open is difficult to understand.

Gas Explosion

With some materials, notably coal, there may be the risk of gas explosion also. In one plant, updraft through the silo discharge gates ignited some of the coal, and when conditions became favorable, gas in the upper section exploded and lifted the silo roof. The correction here was air-tight gates and an air space between silo and cover plate.

An unexpected occurrence was noted upon starting operations at a printing plant. Stacks of bound magazines in this plant pass to cutters which trim the edges. These trimmings drop to an enclosed belt conveyor beneath the floor for transfer to the balers. It was noticed that in the cutting operation a static charge had built up in the trimmings as they fed to the belt.

As no dust was floating along the enclosure the ignition risk was considered remote. However, had there been a dust cloud it certainly would have been essential to provide ventilation and a static-resistant belt with grounded chutes.

In dust explosions, there usually is an initial or local ignition involving a relatively small quantity of dust. This dislodges dust particles collected on beams, shelves, housings, and so forth, providing the conditions favoring a second, more general explosion, or perhaps more accurately a flash fire of destructive extent. The dust explosion hazard may exist in facilities handling aluminum, magnesium, starch, grain, wood flour and sulphur. The National Fire Protection Association codes are well worth careful study.

Fineness of the dust particles is an important factor. Fine dust can be thrown into suspension more readily, disperses more uniformly and will remain in suspension longer than coarse dust. Moreover during the movement of dust through the air, friction may set up a static charge which promotes explosion risk. The electrical capacity of a dust cloud increases with the fineness of the particles. The energy required for ignition or detonation decreases with the particle size, while the rate of flame propagation and the maximum explosion pressures increase.

Table I. Increments of pressure rise

Type of Dust	Rate of Pressure Rise psi per sec
200 Mesh Coal	800
Magnesium Powder	4500
Aluminum Powder	5500
Plastic Powders	1000-2500
Cornstarch	850-3000
Uranium, Thorium	5000-10,000

In the processing of some of the new products we face not only ignition of dust having an extremely high rate of pressure rise (explosion intensity) but possible liberation of toxic products. For example, the burning of nitrogen-containing plastics (urea, melamine and aniline formaldehydes) produces hydrogen cyanide and ammonia gases.

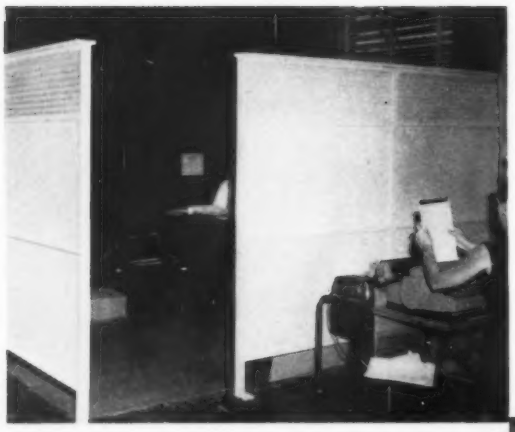
Chloride-containing plastics give off irritating hydrochloric acid vapor. The phenol-formaldehyde plastics produce formaldehyde, which is very dangerous when inhaled. The plastics partially composed of glycerine such as certain alkyd resins, when heated, decompose to give off the extremely dangerous toxic product, acrolin.

A few years ago the Atomic Energy Commission arranged for investigation by the Branch of Dust Explosions, Bureau of Mines, of the risks involved in the dusts of materials such as titanium, uranium, and the hydrides of these metals. Says the bureau report: "Dust clouds of the above listed materials constitute serious potential hazards. Layers of uranium, uranium hydride and thorium hydride, ignited spontaneously at room temperatures within a few minutes after exposure to air. Some of the dusts ignited at elevated temperatures even when submerged in CO_2 or nitrogen. The violence of their explosions, as indicated by the rate of pressure-rise, extended from 5000 to 10,000 psi per second." Contrast these figures with those for pulverized coal—average 370, maximum 780.

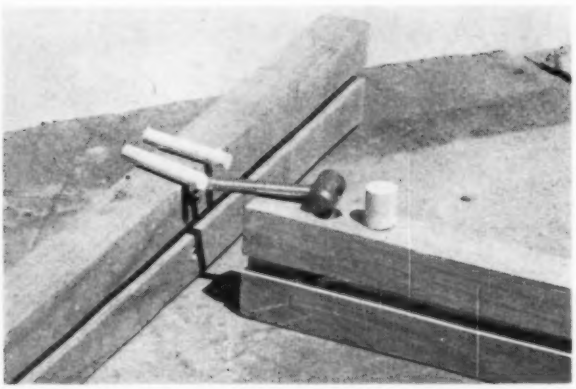
The U. S. Bureau of Mines, will

(Continued on page 208)

Fig. 2. Dramatic proof of effectiveness of a screened pressure vent. Unburned dust escapes from screened opening. Flame shoots out of the unscreened vent



During remodeling operations at Marman partitions like these went up and down in a hurry



Details of frame assembly as described in text. No glue is used, only dowels are utilized to facilitate its disassembly

The long drill template fitted on top of the frame section on the workbench, and the small drill jig being applied to one end of this frame cross-section member, assure accuracy and interchangeability

Modular Panels Cut Partition Costs

MODULAR WALL PANEL sections which can be set up or taken down at will to form a temporary or a permanent office, a hallway, or to enclose any area that needs isolation from other areas, are a product of the plant engineering carpenter shop at Marman Division, Aeroquip Corporation, Los Angeles, California.

R. M. Doyle, Plant Engineer, points out that while the modular panel sections can be used to erect a permanent and very attractive partition, their greatest utility occurs when temporary partitions are needed.

"The panel sections can be set up and joined together in a minimum of time," Mr. Doyle points out. "Then when they have served their purpose in one location, they can be disassembled and moved."

The modular sections are each 6 ft high, and are produced in 2, 2½, 3, 3½, and 4 ft widths. The 4 ft width is most commonly used, with the narrower sections used to fill out any desired partition length. Each modular section contains three individual panels. The two lower and equal-sized panels are of ⅛-in. tempered Masonite which is tough and strong and has no grain to show through the finish coating. The upper panel is either corrugated Plexiglas or wire mesh.

The frames are of ½-in. thick, white ash sawed and planed from rough lumber as needed. This hardwood provides sufficient strength and rigidity so that a modular panel section may be used over and over again without weakening.

After the frame sections have been sawed, planed, cut to length, and grooved, steel drill templates and jigs are used for drilling all assembly bolt and dowel holes. This assures accurate spacement so that all comparable sections are interchangeable. The frame sections are assembled as shown above.

The mullion nut is slid down into the edge-drilled hole in the cross frame section where it anchors the steel bolt entering from the side section. The two dowel pins, driven through the side frame section and into the end of the cross frame sections provide additional rigidity. The mullion nut hole is plugged with a dowel to improve appearance.

Because all modular panel section parts can be produced using standard machines with standard setups, two men can produce on the average about four modular panel sections in 8 hours. **End**

Here's How Selective Plating:

1. Cuts Preparatory Work

2. Lessens Waste of Plating Metal

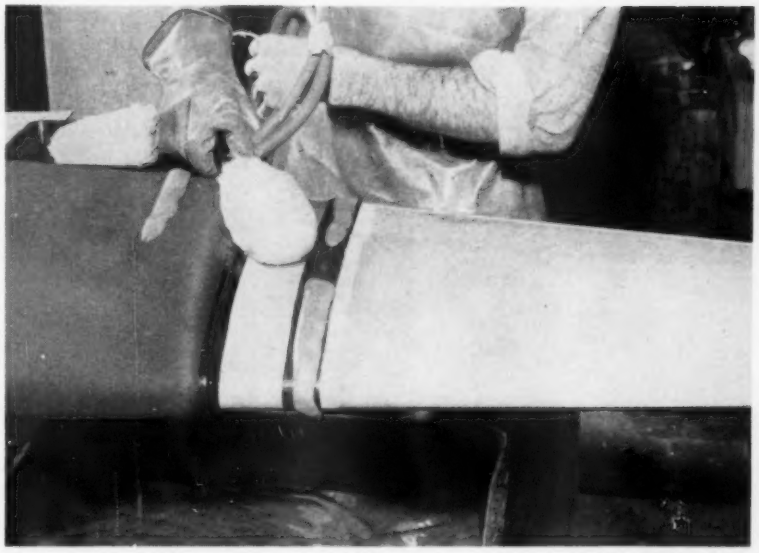
By C. J. **STANSFIELD**, Design and Methods, Production Engineering
Hamilton Standard, Division of United Aircraft Corporation

IN ITS CONTINUING search for new methods, our company, two and a half years ago, investigated a new type of area plating equipment. Since then this equipment has become standard with the company in the making of propeller blades. Originally developed in France and now available in this country, the Dalic plating process is essentially one of "bringing the mountain to Mahomet." Instead of immersing the part to be plated in electrolyte, the electrolyte is brought to the part while the current is passed through.

The process offers us several benefits. It permits the plating of only those exact areas which need to be protected without excessive masking, "stopping off," or other time-consuming operations. The process is fast and eliminates unnecessary waste of metal.

Another important advantage is that the thickness of deposit is extremely uniform and accurate. A special rectifier, used as the principal component of Dalic plating equipment, has a finely-graduated ampere-hour meter whose reading directly measures the amount of deposit. Because the thickness can be controlled within 0.0001 in., the exact desired deposit may be achieved without the need for overplating and subsequent removal of the excess by machining or grinding.

In addition to the rectifier, selective area plating equipment consists of two leads, a cathode and an anode. The cathode is clamped to the work with an alligator clip. The anode is fitted with one of a variety of styluses. Both plug-type and cap-type styluses are available, either water-cooled or air-cooled, depending on their size. On two of the three machines in constant production operation at the Hamilton Standard plant, one medium-sized and one large stylus are used. Both are water-cooled and work equally well.



Here is a steel propeller being manually zinc plated. Plug-type stylus, water-cooled, applies a 2½ in. wide strip zinc plating controllable to within 0.0001 in.

Now, to Work

The prepared stylus is dipped into the appropriate cleaning or plating solution and simply swabbed over the blade area to be plated. To prevent contamination, a different stylus should be used for each solution. For most applications, the continuously variable voltage control on the rectifier is set between 12 and 20 volts to yield current densities ranging up to 6000 amp per square foot.

For over-all surface plating, Hamilton Standard has a large, automatic plating machine which will send the propeller blades through the plating solution as many times as necessary without manual handling. This is used to good advantage by making the plating solution a first step in balancing each blade.

The Dalic plating process follows the standard plating operation and involves a 2½-in. strip of propeller blade surface near the hub end, which has been left unplated because it is deliberately masked during immersion. This masking consists of a rubber "balloon" fitted over the hub end of the blade and inflated with air to about 5 psi to keep the electrolyte from entering.

In finishing off the propeller blade with the area plating equipment, the bare strip of steel is first cleaned with toluol. It is then rinsed with water and rubbed down with 180-grit emery paper until a surface free of water breaks has been obtained. With the cleaning stylus in the anode lead, and the cathode lead

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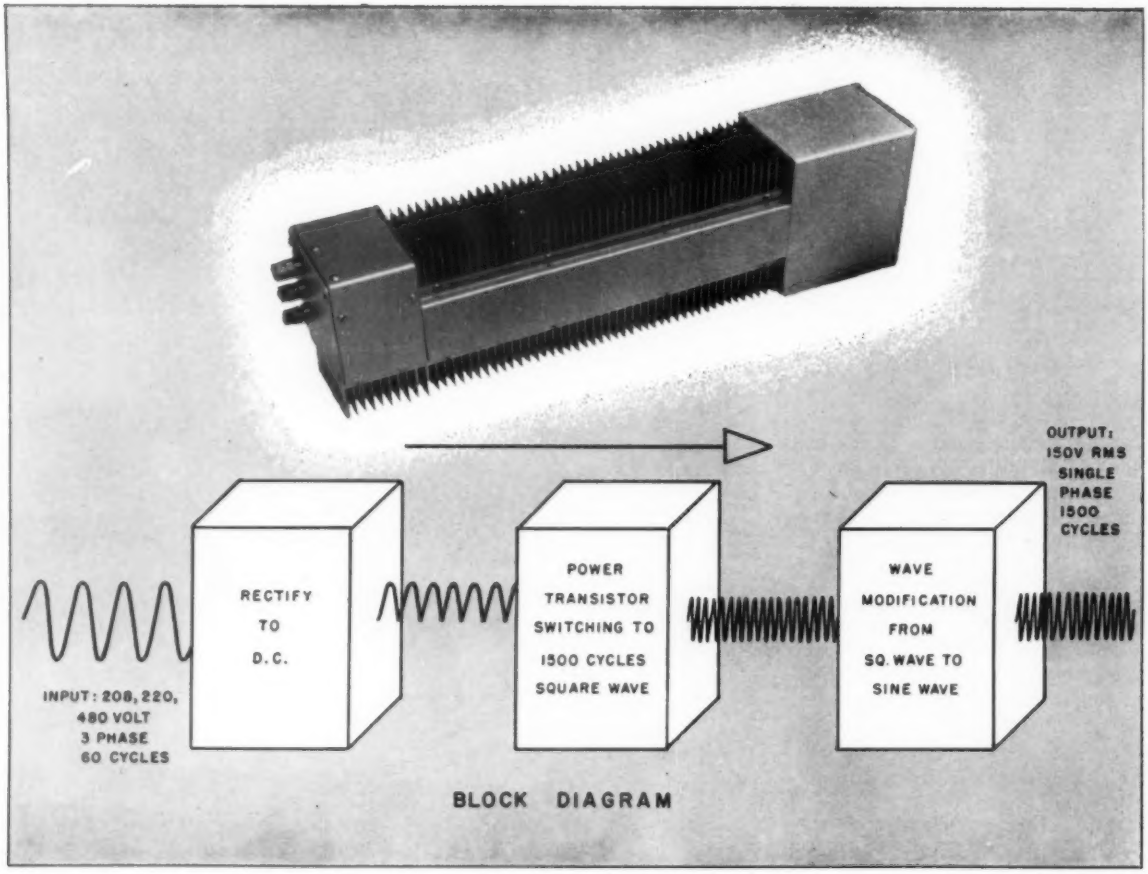


Input three phase voltage is rectified and switched by self-energized transistors oscillating at a frequency of 1500 cycles

New Power Unit for Plant Lighting

Compact High-Frequency Converter Has No Moving Parts

DEVELOPMENT of transistorized high-frequency power sources for lighting systems has been announced by engineers at Westinghouse Electric Corporation's lighting division. When incorporated in standard lighting equipment in coming months, it is expected to eliminate major technical and economic obstacles to the widespread application of high-frequency lighting. With continued progress in transistor production, the new lighting systems are expected to be more than competitive in price with any present day high-frequency system now used in industry.

Prototypes, already functioning in a lighting system for Westinghouse offices, supply power at 1500 cycles to 64 standard 40-watt rapid start lamps. All equipment built so far is designed to operate rapid start fluorescent lamps but there are no obstacles to the design and manufacture of systems for instant start or preheat lamps.

In the area of industrial lighting, the new high-frequency source is expected to benefit both mercury and fluorescent systems. For mercury lighting the principal benefit will be that physical size and weight of auxiliary equipment will be reduced. For fluorescent lamps, benefits will stem from higher efficiency of the lamp as well as from reductions in the size of auxiliaries.

Additional Information

If you would like more information about this frequency converter, just write to the Editor, Plant Engineering, 308 E. James St., Barrington, Illinois, or indicate "Frequency Converter" on the post card in this issue.

How It Works -

THE FREQUENCY CONVERTER is a static device that can be connected directly to a 208, 220, or 480 volt, three phase, a-c distribution system. The input is rectified by a silicon diode bridge and the resulting d-c voltage is impressed across two groups of power transistors. These conduct alternately and work with auxiliary circuits to provide a single phase, 150 volt, 1500 cycle output.

Frequency stability is maintained with high efficiency over a wide range of input voltages. The converter can be continuously energized under no-load conditions since its losses are less than 50 watts. Simple design modifications can fix the output frequency at virtually any point in the audio range.

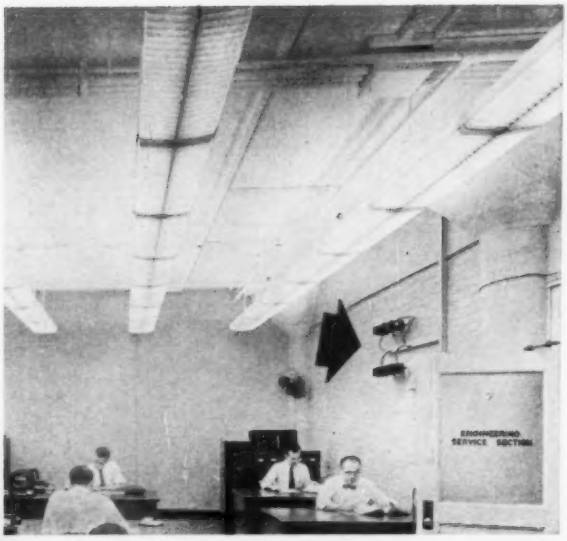
Transistor square wave output is modified to a sine wave

Connected to the power distribution system through a primary switch, each unit will handle a block of lighting consisting of 17, two-lamp, 48 in., T-12, 40 watt fixtures or seven, two-lamp, 96 in., T-12, rapid start, 800 ma. fixtures.

What It Means -

AVAILABILITY OF THIS CONVERTER means that well-known advantages of high-frequency lighting can be more readily realized. Efficiency of fluorescent lamps rises as frequency is increased and at high frequencies the bulk, weight, and losses of ballasts can be reduced. For example, at 1500 cycles the efficiency of a 40-watt rapid start fluorescent lamp is seven per cent above its 60 cycle value, while the ballasts are reduced from a four pound, 42 cubic inch mass having 16 watts loss to a device weighing about seven ounces, occupying about six cubic inches, and having approximately four watts loss.

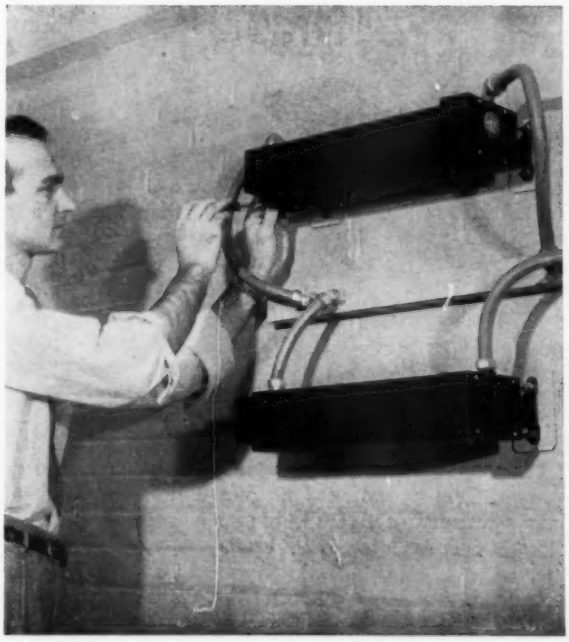
For a given level of illumination, a high-frequency lighting system requires less power input, heat dissipated in the ballasts is reduced, and less overhead space and ceiling structure is necessary to house and support the luminaires. The elements of the system have high reliability and may be located very near to the lighting load. The units are silent in operation and offer freedom from thermal problems inherent in concentrated lighting loads. **End**



Converters, arrow, can be wall mounted near lighting panel

Facts and Figures -

1.5 Kva Power Unit	Input	Output
Frequency	60 cycles	1500 cycles
Phase	Three	Single
Voltage	208, 220, or 480	150
Efficiency	94 per cent at full load 92 per cent at half load	
Power Factor	Unity	
Size	19½ x 4 x 5 inches	
Weight	11 pounds	
Temperature rise	Negligible	
Mounting position	Any	
Protection	Secondary must be protected with a fuse or circuit breaker 10 to 15 amp	
Cost	Expected to be competitive with cost per kva of rotary equipment	
Availability	To be announced	



Engineer makes final adjustment to wall mounted power units

Fig. 1. The on-the-job training program has helped John McHatton, weldor trainee and other craftsmen to earn more by learning more about their particular trade

Training Program Up-Grades Craftsmen

Men at Esso Refinery Learn More, Earn More

FOR MANY YEARS, lack of seniority has usually meant lack of opportunity for younger men in industry's mechanical trades. In many cases, younger employees with ability were held in lower classifications and lower rates of pay until retirements and transfers finally created openings in the first-class ranks.

Until a year ago, this was equally true at Esso Standard Oil Company's refinery at Everett, Massachusetts. Today, however, craftsmen with an ability to learn can attend the company's all-craft Mechanical Training Program. If they successfully complete the course, they receive a first-class mechanic's rating.

Although seniority is still important in other ways at the refinery, the plant's Mechanical Training Program now permits the low-seniority employee to perform first-class work—at first-class pay.

As a result of the program, the refinery today has 16 new first-class mechanics, younger men who might have waited years before they earned top ratings. Also, 46 more craftsmen are well on the way toward earning first-class classifications.

The Mechanical Training Program was developed when it was recognized that training skilled mechanics required "a well-developed plan of work experience, supplemented with related instruction," said Fred B. Lewis, the plant's training supervisor.

Related instruction seemed to be the heart of the problem, and it was through related instruction, both on-the-job and in classroom work, that the refinery developed its program.

Training is offered in all ten refinery crafts — boilermaker, weldor, carpenter, mason-insulator, painter, electrician, instrument man, machinist, pipefitter and rigger. Except for painters and insulators, who

Fig. 2. Tom Cleveland, left, James Bennett, second from left, and Tom MacDonald, right, instrument trainees, watch operator Barry Connors check intricate system

take a three-year training course, all other beginning craftsmen can advance to a first-class rating in five years. Men who have already been working at a craft can reach this goal in an even shorter time.

In setting up its Mechanical Training Program, the refinery created a unique five-man group called the Joint Mechanical Trades Training Advisory Committee, which reviews the progress of trainees and the training program itself. It also makes periodic recommendations as to how the program can be improved.

Two of the committeemen are members of the Everett Refinery Independent Union, and two represent management. Training Supervisor Lewis sits in as a non-voting member, rounding out a union-management partnership that has guided the program.

"Our trainees spend most of their time at on-the-job training," Mr. Lewis reported, "but they also receive from one to two hours classroom work during working hours each week. We also encourage trainees to take after-hours classroom work, at company expense, in subjects that deal with their work —machine-shop methods, electrician wiring, mathematics, blueprint reading and drafting."

On-the-job refinery training is far from routine work. Each refinery job is numbered in progressive steps, beginning at "10" for the easier tasks and working upwards to "1" for the harder jobs, which are usually performed by first-class mechanics. Trainees in the various stages of their development can be "slotted in" at the various job levels so plant foremen know immediately what man is qualified to do what job.

Although plant foremen make monthly "progress reports" on each trainee, the training program is handled by ten training supervisors —one for each craft. R. J. Finigan, the refinery's mechanical superintendent, has responsibility for the over-all direction of the program.

There is no written homework for on-the-job training, but home-

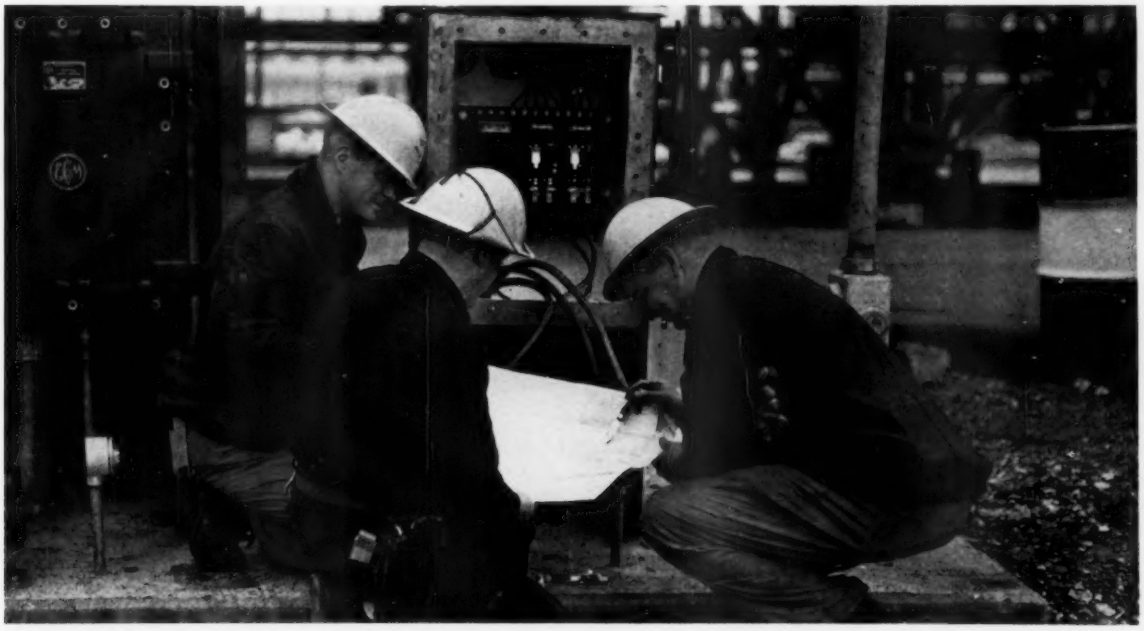


Fig. 3. Electrical trainees Joe Galvin, left, and Jim Doherty, right, study the wiring diagram of a 2300-volt motor starter with first-class electrician Joe DiSessa. The trainees will assist instructor in making the final circuit connections

Courses Offered in Mechanical Training Program

Basic Mathematics
Basic Blueprint Reading
Refinery Mechanics (Physics)
Electric Wiring I and II
AC Circuits and Machines
Industrial Instrumentation
Instrument Craft Information
Fundamentals of Electronics
Industrial Electronics
Boilermakers Layout Course
Pipefitters Layout Course
Machine Shop Information
Painting Shop and Related Information
Carpenter Shop and Related Information
Masonry and Related Information
Oxy-Acetylene Welding
Welding Metallurgy
Riggers Craft Information

Text Books and Other Written Material Used

Shop Mathematics
Rogers and Welton—
Silver Burdett Co.
Blueprint Reading at Work
Rogers and Welton—
Silver Burdett Co.
Production and Refining
Dept. of Trade & Ind. Educ.
Oklahoma A & M College
Hales Question Book
National Electric Code
New Metal Worker Pattern Book
G. W. Kittredge & Associates
Laying Out for Boilermakers,
Sheet Metal Workers and
Plate Fabricators
G. M. Davis
Sheet Metal Mathematics Text Book
N. Y. State Vocational and
Practical Arts Association
Delmar Publishers
Marine Boilermaking Practice
U. S. Office of Education
Bulletin 345-T
Painting and Decorating Craftsman
Manual and Text Book
T. Audel and Co.
Carpenters and Builders Guide
T. Audel and Company
Cameron Hydraulic Data
Ingersoll-Rand Co.
American Pipe Manual
American Cast Iron Pipe Co.
Machinists Ready Reference
C. Weingartner
Prakken Publications
Welding Metallurgy
Henry & Claussen
American Welding Society
Oxy-Acetylene Handbook
Linde Air Products Co.
Oxy-Acetylene Welding and Cutting Instruction Course Lectures
Air Reduction Co.
Welding Forums
Esso Research and Engrg. Co.
Bricklaying
Dalzell-Townsend
Masonry and Bricklaying Booklets
Louisville Cement Co.
Bricklaying I—Vocational and
Apprentice Training
Structural Clay Prod. Inst.
Blueprint Reading for Building
Trades—J. E. Kenney
Basic Instrumentation
Petroleum Industry Series
University of Texas
Service Department Training
School Bulletins
Minneapolis-Honeywell

work may be required by instructors teaching classes after hours. A close tab is kept on each trainee's progress, however, through the foremen's reports and by "oral quizzes" that are made when the men tackle new, unfamiliar jobs. A trainee's progress is reviewed each month and if a man is making a conscientious effort to master his craft, supervisors encourage him to continue his studies.

"We 'test' by performance," Mr. Lewis said. This is mainly on the basis of the reports made on the trainee's work. If a trainee is progressing satisfactorily, he will climb one more step—at additional pay—every six months. If he is not, he is held back. If he does not qualify at the end of the next six-months period, he is dropped from the program. A man who cannot master his craft is "red circled," and he remains at the highest level he reached as a trainee.

Classroom work, during working hours is an integral part of the training program. It is here that the trainees discuss—and attempt to solve—plant problems that would not ordinarily come to their attention. These discussions, the training supervisors feel, help the men understand their own work better. It also gives them a better picture of other problems. **End**

Fig. 4. Frank Cloudman and Harry Hansen, pipefitter trainees, check blueprints during the installation of new piping at the refinery's soda regeneration unit

Industrial Lighting

THIS MANUAL PRESENTS MANY FACTORS TO BE CONSIDERED BY THE PLANT ENGINEER IN THE DESIGN AND OPERATION OF INDUSTRIAL LIGHTING SYSTEMS . . . THE AUTHOR BRINGS YOU HIS PLANT EXPERIENCES IN SELECTION OF VOLTAGES, RELATIVE COSTS, ECONOMIC ANALYSES, GROUP REPLACEMENT TIME STUDIES, EFFECT OF DIRT ON LAMPS AND FIXTURES AND A STUDY OF LAMP COSTS INDICATING THAT LOWEST FIRST COST MAY NOT BE THE LOWEST TOTAL COST . . . THESE COMMON-SENSE PRINCIPLES WORK

The Author:
EDWARD G. ARSNOW, Engineer
Merrimack Valley Works, Western Electric Company, Inc.

A Manual for the Economic Analysis of Lighting Systems

Modern installation of a 277 v lighting system incorporating the design features covered by the author in this article

AFTER SOME of the basic planning for the construction of a new industrial plant has been completed, such as the accumulation and classification of load, population and space requirements, the electrical engineer is called upon to determine the most economical voltage at which power should be distributed.

He must also consider the effects imposed upon this distribution system by the general lighting equipment. At this stage the engineer consults with management for approval of his recommendations which have been based upon sound lighting principles. This is a crucial point. A poor executive decision may hobble the effectiveness of future operations and it is here that the manager should bring an intimate knowledge of the overall economics to bear on the problem.

Included in the scope of the problem should be a realization of the benefits of adequate levels of illumination and their impact upon production. It should be understood that the most economical lighting systems, from the standpoint of overall cost, are not necessarily those with either the lowest initial cost or with lowest operating costs, and that the economics of the problem should not overshadow comfort or quality considerations.

In addition to the above, of course, is the problem of determining relative costs of general overhead and local supplementary lighting.

At some early stage in the planning process, management must be able to evaluate recommendations of the engineer regarding the level of illumination most suitable for the plant. It is common knowledge that different visual tasks in the plant call for greater or lesser light intensities and that proper selections for particular applications will have a strong influence upon the efficiency of future operations. Let us examine these effects of light intensity upon production.

It is reasonable to assume that a machine operator, in order to maintain high production, must be provided with a quality and quantity of illumination commensurate with his task (Fig. 1). This brings us to the problem of maintaining human efficiency.

For many years, efficiency has been mainly associated with worker output by time and motion analysis. This is really only part of the problem. Many appraisals neglect input which, in the author's opinion, is a necessary factor in the equation used in the determination of any problem in efficiency.

Efficiency is defined as the ratio of useful output to the total input. This takes into consideration useful plus useless performance. Unfortunately, this same law is seldom applied in the practical evaluation of human performance. Human efficiency is generally measured by output per hour or per dollar with little regard for the total human energy input. This type

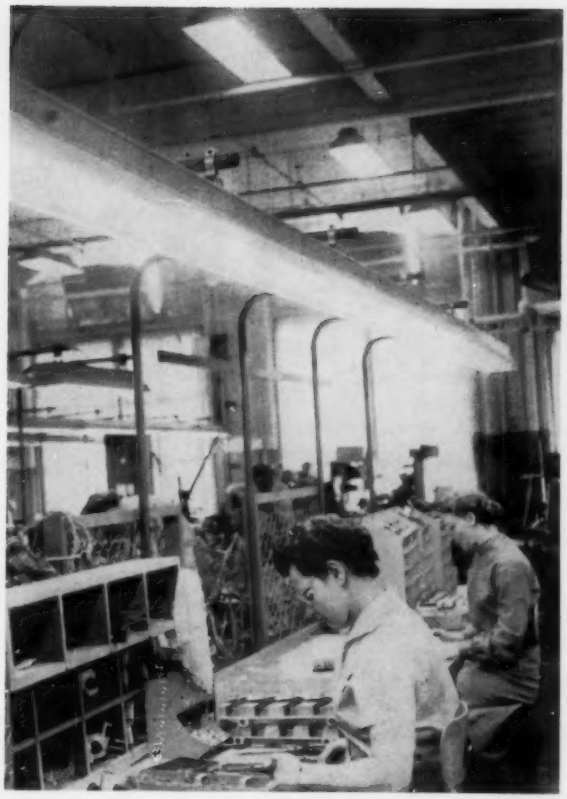


Fig. 1. Bench lighting can produce high illumination levels

of reasoning completely overlooks such considerations as "wear and tear" on all parts of the worker as well as the waste of human energy and resources, and gives insufficient thought to reserve resources.

A great deal of study has been done on this subject, both interesting and valuable to the industrial manager. Figure 2, for example, is a simple graph showing the "expenditure of human resources" as a function of the ease of seeing.

The lower curve is representative of the expenditure of the relative amount of energy or resources in the performance of useful work as measured by the rate of working as the level of illumination increases. It is important to observe here that even after the rate of increase of useful work becomes nearly static, the expenditure of resources in useless work continues to decrease as the critical task of seeing becomes easier.

It becomes immediately apparent that when seeing is difficult, the worker is called upon to drain a large portion of his visual resources and that proper illumination releases him from unnecessary burdens. There is a great deal of scientific evidence to demonstrate the soundness of this viewpoint. [1]

In recent years a number of rigidly controlled experiments have been conducted in the plant and in the laboratory. Both clearly indicate that higher levels of illumination result in higher work efficiency. Unfortunately space limitations prevent a detailed treatment of this particular facet of our subject.

Once the level of illumination has been objectively determined, the subject of the lighting system operating voltage should be given careful scrutiny.

For any new manufacturing plant, the determination of the proper voltage for distribution naturally requires considerable study. The factors covering this selection generally include the size, concentration, type and location of all loads. These, of course, involve lighting loads which, in modern plants, are a significant part of total requirements.

High Voltage Systems

In the past, most lighting systems operated at 120 v. It was necessary to transform higher potentials to lower levels at considerable cost in order to suit the requirements of the lighting system. This additional cost was frequently a factor in causing substandard lighting to be selected.

In modern plants, however, where the trend is toward higher intensities, it has become necessary to lower this economic barrier. Higher operating voltages was one answer. Quite recently the 277-v fluorescent fixture was introduced to allow direct connection to the 277/480-v systems currently provided for most new plants. (Fig. 3.) Although operation at this higher voltage can effect economies of operation, it should not be selected indiscriminately.

A detailed comparison of total annual costs of all possible systems should be made. It should be noted that superficial economy is not the sole criterion for lighting system determination.

There are many types of systems available for installation including incandescent, fluorescent, and mercury vapor, and each of these has particular environ-

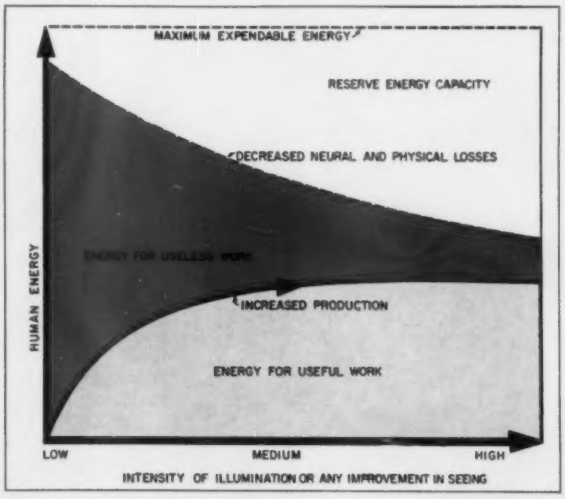


Fig. 2. Improved seeing conditions can increase production

[1] Important Concepts of Lighting and the Job, Technical paper by Sylvester K. Guth, November, 1951.

ments for which it is best suited. Consequently, it is necessary to be able to differentiate between them.

Since we are confining ourselves to the economics of the problem, even though there are other important physical considerations, it is desirable to examine Table I for a suggested method of cost comparison between systems.[2]

How to Make a Cost Analysis

The basic elements to be used in comparing different lighting systems may be broken down to initial and operating costs. Either of these may possibly be the dominating factor, but we can combine them into a "total cost" indicator. Computing such total costs for various systems must be predicated on the following common assumptions if comparisons are to be valid:

(a) Equal illumination levels in all cases. Adjustments shall be made to equate all costs on this basis.

(b) Equality in amortization rates of initial investments as well as for interest, taxes and insurance shall be maintained at ten per cent for write-off of investments and five per cent for the remaining items.

(c) Operating conditions shall be equal for each system under consideration, e.g., electric power rates, burning hours per annum and starting frequency.

(d) Each system shall be cleaned in a manner which is appropriate.

(e) For estimating installation, cleaning and relamping, labor rates shall be uniformly taken.

(f) Fixture mounting in this case shall be at a uniform height of 14 ft.

[2]Fundamentals of Lighting Cost Analysis, A. C. Barr, C. L. Amick, Technical paper, I.E.S., August 27, 1951, Washington, D.C.

(g) Physical proportions of the areas compared shall conform to room Index A, (See Illuminating Engineering Society's Lighting Handbook) and reflectance factors shall be 70 per cent for the ceiling and 30 per cent for the walls.

The analysis in Table I shall be divided into four major classifications as follows:

Basic Data: Section A shall establish the fundamental factors which are to be the basis of our calculations.

Initial Cost: Section B shall establish the net costs of procurement and installation of the various systems.

Annual Operating Cost: Section C provides the operating charges of each of the systems being considered.

Total Annual Cost: Section D supplies total annual cost of each of the systems. Generally, these figures are of utmost interest to the manager because it provides him with a realistic tool for comparison.

In order to make values in the Table I Basic Data analysis realistic, it is necessary to present the following comments:

For item 3, the manufacturer's published wattage data should be used rather than nominal values because actual wattage is generally less.

For Item 5, the coefficient of utilization, based on actual room size and reflectance factors should be accurately determined for individual cases.

For Item 6, the maintenance factor should be a realistic figure based on existing conditions such as mean lamp output, loss of illumination due to a reduction in room surface reflectance factors, and mean depreciation in output caused by the accumulation of dirt on lamps and reflectors.

Under Item 8, we find the multiplying factors that are introduced to adjust individual systems to a com-

Fig. 3. This modern installation is supplied by an enclosed bus and is controlled by magnetic contactors in the trusses

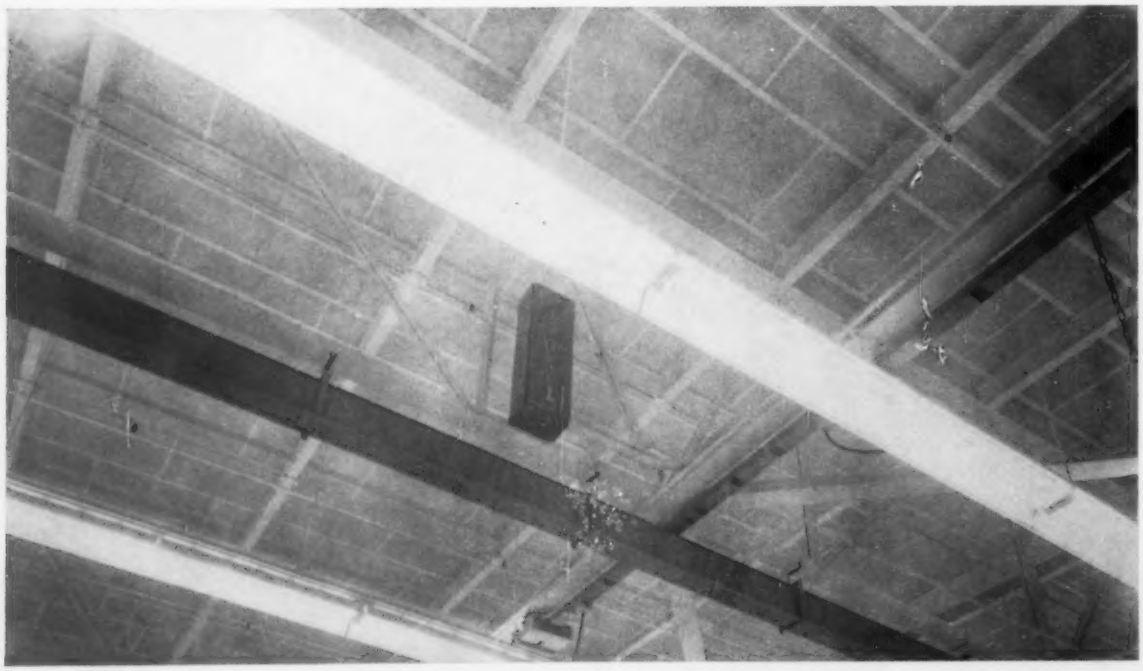


Table I. Analysis to determine the relative effect of various voltages and fixtures on initial, annual operating and total annual costs for systems using fluorescent lighting

	Method I—Slimline Instant Start 120 Volt 8 Ft. Section 2-96T12 (Lead-Lag)		Method II Slimline Instant Start 277 Volt 8 Ft. Section 2-96T12		Method III 90 Watt Sequence Start 277 Volt 10 Ft. Section 4—90 Watt—T 17	
BASIC DATA (Section A)						
1. Rated initial lamp lumens per luminaire	10,100		10,100		20,600	
2. Lamp life (Hours)	7,500		7,500		7,500	
3. Average watts per lamp	74		74		90	
4. Watts per luminaire (includes ballast watts)	184		180		396	
5. Coefficient of utilization	0.74		0.74		0.72	
6. Maintenance factor	0.77		0.77		0.77	
7. Effective maintained lumens per luminaire (Items 1 × 5 × 6)	5,750		5,750		11,420	
8. Relative number of luminaires needed for equal maintained ft-c. (Item 7 (Col. 1) ÷ 7)	1.00		1.00		0.503	
INITIAL COSTS (Section B)						
9. Net luminaire cost	$48.40		$45.60		$51.00	
10. Installation and branch circuit wiring cost	20.00		18.00		20.00	
11. Net initial lamp cost including tax	3.95		3.95		7.00	
12. Total initial cost per luminaire (Items 9 + 10 + 11)	72.35		67.55		78.00	
13. Annual owning cost per luminaire (15% of Items 9 + 10)	10.26		9.54		10.65	
14. Relative initial cost for equal maintained footcandles $\frac{\text{(Items 12 × 8) for system compared}}{\text{Item 12 for base system}}$	1.00		0.935		0.544	
ANNUAL OPERATING COSTS (Section C)						
15. Burning hours per year	2500	4000	2500	4000	2500	4000
16. Annual energy cost $\frac{\text{(Items 4 × 15 × rate in ¢ per kwhr)}}{100{,}000}$ 1¢ per kwhr	$ 4.60	$ 7.35	$ 4.50	$ 7.20	$ 9.90	$15.85
2¢ per kwhr	9.20	14.70	9.00	14.40	19.80	31.70
17. Number of lamps replaced per year $\frac{\text{(Item 15 × no. lamps per unit)}}{\text{Item 2}}$	0.67	1.07	0.67	1.07	1.33	2.14
18. Lamp cost (Item 17 × net price per lamp including tax)	$ 1.32	$ 2.11	$ 1.32	$ 2.11	$ 2.35	$ 3.75
19. Labor cost of lamp replacements (24 minutes @ 2.50 hr)	0.67	1.07	0.67	1.07	1.33	2.14
20. Cost of cleaning twice per year	1.70	1.70	1.70	1.70	2.00	2.00
21. Total annual operating cost per luminaire (Items 16 + 18 + 19 + 20) 1¢ per kwhr	8.29	12.23	8.19	12.08	15.58	23.74
2¢ per kwhr	12.89	19.58	12.69	19.28	25.48	39.59
22. Relative annual operating cost for equal maintained footcandles $\frac{\text{(Items 21 × 8) for system compared}}{\text{Item 21 for base system}}$ 1¢ per kwhr	1.00	1.00	0.988	0.985	0.945	0.975
2¢ per kwhr	1.00	1.00	0.985	0.985	0.995	1.015
TOTAL ANNUAL COST (Section D)						
23. Relative total annual cost for equal maintained ft-c $\frac{\text{(Items 13 + 21) × (Item 8) for system compared}}{\text{(Items 13 + 21) for base system}}$ 1¢ per kwhr	1.00	1.00	0.955	0.962	0.714	0.766
2¢ per kwhr	1.00	1.00	0.955	0.965	0.784	0.845

mon denominator of equal maintained levels of illumination.

An examination of Table I will show that the analysis is made on a "per luminaire" basis with adjustments for equal illumination results. This eliminates the often inaccurate comparison of levels of illumination and quantity of luminaires which are difficult to study by usual methods not based on common ground.

Section B concerns itself with the determination of initial costs of procurement and installation of the various systems. The following comments should be given careful consideration before any attempt is made to establish cost data:

Item 10, installation costs, may be supplied from a local contractor or electrician. The extent of such costs is varied by mounting heights, method of installation and other pertinent aspects. It should include complete wiring costs.

Wiring Costs—How to Figure Them

There are no figures available for general use; therefore, each case requires individual attention. It should be emphasized, however, that wiring costs on a per luminaire basis, for different systems of comparable efficiency, can be expected to be similar. Because of relatively long amortization periods, which may be as long as fifty years, a small variation in the initial cost will have little effect on the net result.

In this case, the insertion of the procurement cost of the luminaire itself will suffice. However, when the difference in system efficiency is substantial, as in filament vs fluorescent lighting, wiring costs should be included to reduce the possibility of error.

Lamp costs in Item 11 are introduced as an initial expenditure even though replacements are charged later as operating expense because it originally represents part of the original capitalized investment.

The amortization rate used in Item 13 should be in accordance with the established accounting procedures of the individual plant. The original lamp cost in this analysis is not amortized although some accounting practices might require its cost to be included.

Section C gives annual operating costs. It is desirable to subdivide these figures into 2500 burning hours for one shift basis and 4000 hr for two shift basis to show effects upon annual operation. For purposes of this study, two energy rates were also introduced to illustrate the results of a variation in this quantity.

Total annual cost is combined under Section D and it is obtained by adding the annual owning cost per luminaire to the total annual operating cost per luminaire and multiplying this sum by the factor determined earlier (from a relationship between rated initial lamp lumens per luminaire) for equal levels of illumination.

For purposes of system selection, the total annual cost figure is of great importance to the accountant, who is budgeting either capital investment or operating expense. Cost data made available in this form may be helpful.

It is possible to develop the relative costs in Table I into actual dollar values by performing the following calculations:

(a) Determine the area lighted by each luminaire by dividing the effective maintained lumens per luminaire by the desired footcandle level.

(b) Determine the luminaires needed by dividing the total area to be lighted in square feet by the area lighted by each luminaire found in paragraph (a) above.

(c) Determine the actual initial cost in dollars by multiplying the total initial cost per luminaire by the number of luminaires.

(d) Determine the actual owning cost in dollars by multiplying the annual owning cost per luminaire by the quantity of luminaires. To determine the total annual cost, simply add the annual owning cost and the annual operating cost. Steps should be taken to correct the difference in luminaires proposed and luminaires actually used. Frequently, a difference arises because of obstructions caused by the relation of room dimensions to luminaire length and orientation.

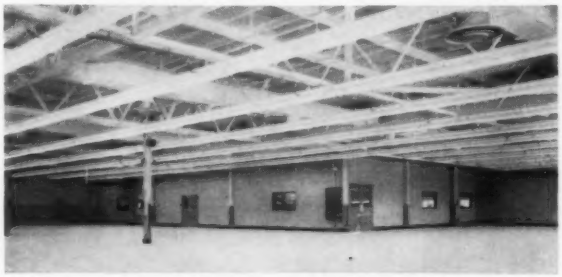


Fig. 4. Ventilating slots in reflectors reduce dirt accumulation and improve the ratio of floor-to-ceiling brightness

Accounting practice in some plants requires that overhead be distributed on the basis of cost per square foot for a particular department or area. This method of analysis can provide lighting cost data which is of value to the accountant in arriving at a reasonable unit cost.

This unit cost is obtained by multiplying the footcandle level for the area by the total annual cost per luminaire and then dividing this result by the effective maintained lumens per luminaire.

The value of such an analysis needs little description beyond what has already been said. However, mention should be made of some additional useful results.

It is possible to use this method to determine the effect of variables appearing in the table, such as energy cost and initial lamp cost.

The use of a uniform method of analysis of this type is necessary in order that analysis made by different individuals may readily be evaluated.

Assuming that a method of comparing various systems on a common basis has been established, the results of data calculated for three systems proposed for the same plant may be compared.

Selected for this study are the three proposals shown in Table I. Each is a distinct system. Data for Method

I has been prepared to indicate all of the facets of a typical slimline system operating on a 120-v circuit. It is compared to Method II and Method III. Method II is similar to Method I and differs only in operating voltage. Method III is similar to Method II in operating voltage only, but the type and number of lamps are different.

The table illustrates the possible variations in initial cost, operating and total annual cost. It is evident that 277-v operation may or may not be more economical and that it would be difficult to finally determine this without further analysis.

In this particular instance, a manager would find it almost impossible to differentiate between these systems without an investigation of this nature. It wouldn't be known that Method II was five per cent less in cost than Method I and that just a variation in operating voltage could effect this saving. Neither would it be known that Method III would cost from 18 to 25 per cent less than Method II, even though it was operating at the same voltage.

The data[3] in Fig. 5 has been prepared in order to further demonstrate the possible variations in total annual operating costs and the effects of fixed and variable charges.

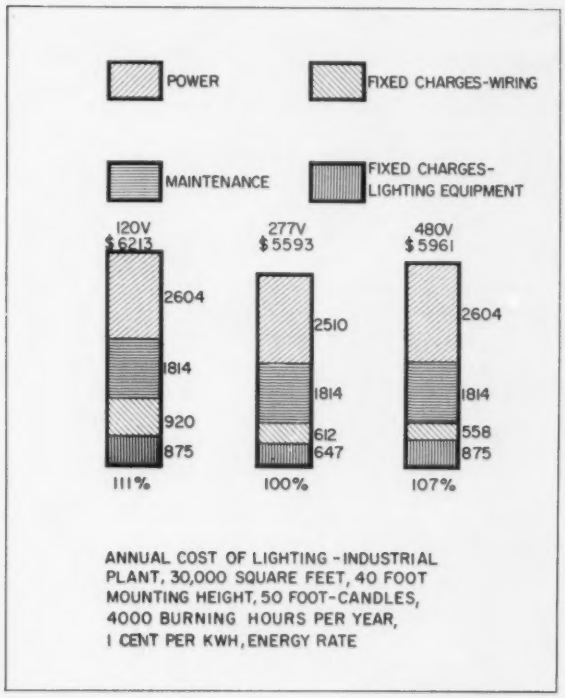


Fig. 5. Effects of voltage on annual cost of lighting. Economic analysis of all factors insures lowest cost system

This bar graph illustrates the variation in cost associated with three different systems that might be used to supply a lighting system in a hypothetical industrial plant of 30,000 sq ft where the mounting height is 40 ft, the intensity is 50 ft-c, the burning hours per year is 4000, and the energy rate is one cent per kwhr. The values used in this graph were essentially determined by the same method that was used in Table I except that total costs have been indicated.[4]

There is a basic difference between this type of lighting installation and the one analyzed previously. The physical conditions differ considerably. Previously we compared data for fixtures mounted on an elevation of 14 ft which is common in many general manufacturing areas. In our new hypothetical installation we are dealing with a typical high bay industrial area with a mounting height of 40 ft.

Effects of Mounting Height

Units most economical in the previous case would be less desirable at the higher elevation because the cost factors change with an increase in height. In Table I the conventional 277-v, 90-w, T-17 lamp is lowest in cost, yet in the high bay area a system using this lamp may become expensive. Variations in the power, maintenance and fixed charges are responsible. Mercury Vapor A-H12, 1000-w units may be more economical than the three types listed for comparison because of low initial cost, low overall cost and minimum maintenance. Maintenance is an extremely important factor in high ceiling areas because lamp replacement becomes more difficult. Special methods[5] must be devised to enable workmen to reach elevations that are not accessible from a common stepladder. Since labor and maintenance costs become greater as lamp heights are increased, it is desirable to reduce the number of operating units and to select a lamp having a long life and a greater lumen output.

The fact that the life of fluorescent lamps is affected by the number of times they are lighted has been known for some time. This is the reason that manufacturers' ratings are based upon a specified number of burning hours per start.

If we combine this with an increase in the cost of electrical energy for longer burning periods, it becomes immediately evident that there is some point beyond which it is not economically feasible to allow lamps to "burn". These are the factors involved:

First, a comparison of overall costs must be made, and in the interests of simplicity we shall concern ourselves in the following example only with the cost factors involving a single lamp.[6]

1. Method of Determining Cost

Operating cost in $ per lamp per day =

$$\frac{W \times E}{1000}(A + B + C) + \frac{R}{7500}\left(\frac{A}{L_a} + \frac{B}{L_b} + \frac{C}{L_c} \cdots\right)$$

W = lamp and ballast watts
E = energy in $ per kwhr
R = lamp and replacement cost
A, B, C, . . . = periods of burning time in hours

[3]Cost Analysis—Industrial Lighting Systems, November 24, 1954, M. Christensen, R. V. Ridenout, General Electric Co., Cleveland, Ohio.

[4]Economics of Mercury Lighting for Industrial Areas, Illuminating Engineering, September, 1954, W. H. Johnson, W. H. Kahler, D. W. Rowten.

[5]Lighting Maintenance General Electric Company Publication LS-155, 1953, Page 8

[6]The Lighting Engineer—General Electric Co., Vol. III, Number 2, April, 1955.

L_a, L_b, L_c, ... = standard lamp life for each burning period relative to lamp life at 3 burning hours per start is 7500 hr. See Fig. 6

Assuming that a 40-w preheat lamp is burned continuously for a 9-hr working day and again for a half-hour at night; that the energy rate is $.015 per kwhr; that lamp cost is $.077; that replacement cost is $.050 per lamp; and that lamp and ballast watts are 47.75, let us determine whether lamps should be turned off during a fifteen minute "break" period when they are not needed.

Cost when left burning - - - - - -

$$= \frac{47.75 \times 0.015}{1000}(9 + 0.5) + \frac{0.77 + 0.50}{7500}\left(\frac{9}{1.43} + \frac{0.5}{0.52}\right)$$

$= 0.00680 + 0.00123$

$= \$0.00803$ per lamp per day or 8.03 mills per lamp per day

Cost when turned off - - - - -

$$= \frac{47.75 \times 0.015}{1000}(4 + 4.75 + 0.5) + \frac{0.77 + 0.50}{7500}\left(\frac{4}{1.1} + \frac{4.75}{1.16} + \frac{0.5}{0.52}\right)$$

$= 0.00662 + 0.00147$

$= \$0.00809$ per lamp per day or 8.09 mills per lamp per day

From the foregoing example, we find that a reduction of 0.06 mills per lamp per day could be effected by allowing lights to remain on during the break period. The saving is rather insignificant because the fifteen minute period in question is approximately as long as the break-even period, which in our problem would be twenty minutes.

We may conclude that if any saving is to be realized by turning lamps off, the off period must exceed the break-even point by a substantial amount.

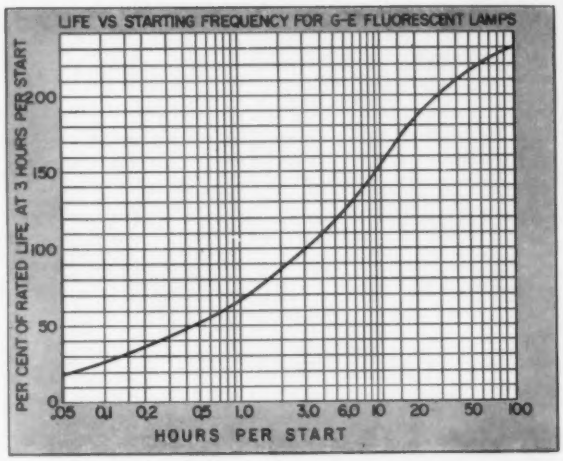


Fig. 6. Life of fluorescent lamps is affected by number of times they are started. This is a key to more efficient use

Russell Churchill of General Electric Co. offers these generalizations:

(a) "The greater the number of questionable periods, the greater the possible saving in making the right decision about turning off the lamps or allowing them to burn. Where frequent turn-offs are indicated it is especially important to weigh the economic saving against inconvenience of frequent switching."

(b) "The higher the energy rate, the shorter the break-even periods, the periods during which it makes no difference whether you turn the lamps off or let them burn."

(c) "If you compare lamp for lamp, it's more important to make the right turn-'em-off-or-let-'em burn decision with slimline systems than with general-line or 40-w rapid-start systems. If you compare lumen for lumen produced by various systems, there's not much difference in the economics."

Industrial Lighting-Maintenance Cost Considerations

TO MANY PLANT MANAGERS, the subject of maintenance generally denotes unavoidable, unpleasant expenditures which frequently seem greater in amount than they should be. One corporation, for example, measures the efficiency of its maintenance program solely by the ratio of actual expenditures to recovery and refers to low ratios as "good performance". On the surface, a policy of this nature appears to be the manifestation of good sound business judgment, yet, this view could possibly be quite the reverse.

If it is assumed that these lower costs have been the result of planned reductions in maintenance on capitalized equipment, one must naturally expect a reduction in the life of the facilities. This is true for lighting equipment as well as machinery.

When an engineer formulates his plans for the design of a lighting system, he introduces a factor which is an estimate of the quality of maintenance that can be expected. This estimate takes into consideration such things as the general cleanliness of the area, the natural depreciation of lamp output and the frequency of lamp replacement and cleaning.

A natural question at this point would be, "What is good lighting maintenance?" A number of methods are available by which we can measure and achieve good lighting maintenance.

Optimum conditions vary according to the type and design of the fixture. This maintenance factor, in decimal form, is divided into the quantity of fixtures required to obtain the required illumination level to

compensate for normal depreciation in output. When there is evidence that management intends to carry out a program of minimum maintenance, this factor is reduced accordingly. It is interesting to consider the meaning of such a reduction.

A reduction in the "maintenance factor" enlarges the required number of fixtures which in turn causes an increase in investment, in fixtures to be cleaned, in lamps to be replaced, and in the cost of electrical energy. A situation could arise where a plant manager's proud display of excellent "maintenance performance" becomes meaningless due to the existence of these wasteful hidden costs.

A few years ago, the practice of group replacement of lamps was relatively unknown outside of the public utility field. Its genesis there was natural because the maintenance of street lighting is one which consumes

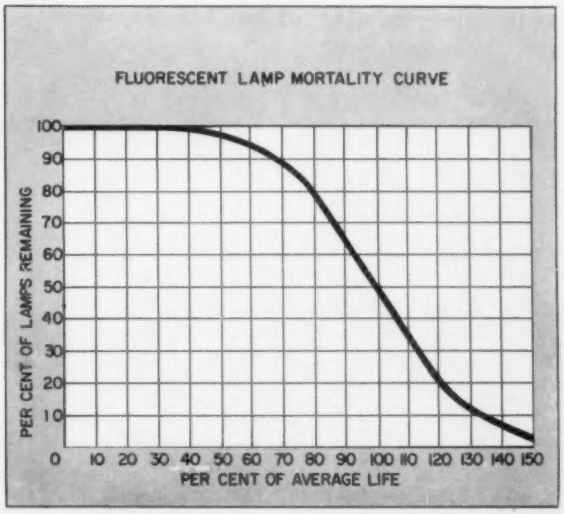


Fig. 7. Predicting the life expectancy of a group of fluorescent lamps forms the basis for group replacement programs

a considerable amount of time and money. The uniformity of expected life created by the application of statistical methods in the manufacturing process of lamps was largely responsible for group replacement practice.

Data was accumulated,[7] analyzed and finally it became possible to predict, with reasonable accuracy, the number of 'burn-outs' which would occur within any given time. Fig. 7. illustrates the relationship of individual lamp mortality to anticipated normal life.

It may be seen that failures increase substantially in number after the point of 80 per cent normal life is exceeded. This is obviously an important factor in determining the time to replace.

As a result of the favorable results obtained in the field of street lighting, engineers and maintenance personnel began to apply the same principles to other installations involving large quantities of lamps. Experience has shown that considerable savings may be effected in most cases. It was natural that the group lamp replacement practice eventually appeared in the industrial plant.

Group replacement methods are relatively simple. Generally, they consist of the following steps:

(a) Complete replacement of all existing lamps at the beginning of the first cycle.

(b) Selection of a percentage of the best lamps removed (generally about twenty per cent) and their storage in a convenient location.

(c) Replacement of individual lamps out of the supply provided in step (b).

(d) After the quantity stored in step (b) has been completed, all lamps in operation are group replaced with new lamps.

(e) Repeat the cycle starting at step (b).

The following calculations illustrate the methods and the results of a study of actual conditions made by the author in a manufacturing plant involving 2250 overhead industrial fluorescent fixtures. (See Fig. 8). It is presented in its entirety and is intended to show the effects of material and labor only.

The purpose of this study was to determine the most economical method of replacing fluorescent lamps in an industrial area containing 2250 lighting fixtures.

There were 4500 lamps in service and their life expectancy was estimated to be 10,000 hr. Statistics supplied by lamp manufacturers indicated that 7500 hr of life could be expected when operated three hours per start and that lamp life is increased substantially when burned for longer periods. The estimate of 10,000 hr was satisfactorily substantiated by actual lamp purchase records of the plant maintenance organization.

Fig. 8. Rolling scaffold permits low cost maintenance of fixtures and is used for group replacement and cleaning work

Replacing lamps singly as they burn out results in the following costs.

$ATC = (ALR \times M) + (ALR \times U \times TS)$
$ATC = (2250 \times 0.60) + (2250 \times 2.98 \times 0.244)$
$ATC = \$2980.00$

ATC = Annual total cost
ALR = Annual lamp replacements
M = Material cost per lamp
U = Labor cost per hour
TS = Replacement time in hours (See Table II)

Group replacement at 10 per cent failure point — For this step in the process, we shall study a program where

[7]See-Better—Work-Better Bulletin, No. 3, General Electric Co. Publication 1-b-1216

the first 10 per cent of lamp failures will be replaced individually and the remainder installed on a group basis in accordance with recommended practices.

From the lamp mortality curve we find that when 10 per cent of the lamps have failed those remaining have reached 65 per cent of their 10,000 hr life expectancy and as a result, the quantity of lamps to be replaced is increased.

Annual cost of labor for 10 per cent individually replaced lamps plus 90 per cent group replaced

$$\frac{L \times R \times U \times TS}{F \times 0.65} + \frac{L \times U \times TG}{F \times 0.65} = ALC$$

$$\left(\frac{4500 \times 0.10 \times 2.98 \times .244}{2 \times 0.65}\right) + \left(\frac{500 \times 2.98 \times 0.0484}{2 \times 0.65}\right) = \$753 \text{ per annum}$$

L = Lamps in service
R = Replacement factor
U = Labor cost per hour
TG = Replacement time in hours per lamp for group replacement (See Table III)
ALC = Annual labor cost
AMC = Annual material cost
ATC = Annual total cost
F = Factor to convert to annual basis. (one year = 5,000 hr)
M = Material cost per lamp

Note: The factor of 0.65 is to account for the increase in the quantity of lamps due to group replacement at 65 per cent of estimated life. Overhead charges and power costs are omitted.

Annual material cost is computed as follows:

$$\frac{L \times M}{F \times 0.65} = \frac{4500 \times 0.60}{2 \times 0.65} = \$2080 \text{ per annum}$$

ATC = AMC + ALC = \$753 + \$2080 = \$2833 per annum

Therefore, the annual saving by this method is the annual cost for single replacement minus annual total cost for group replacement = \$2980 — \$2833 = \$147.

Group replacement at 20 per cent failure point—It will be assumed the first 20 per cent of lamp failures will be replaced individually and the remaining 80 per cent will be replaced as a group. The mortality curve at this point indicates the remaining lamps in service have reached 80 per cent of expected life.

Annual cost of labor:

$$\frac{900 \times 2.98 \times 0.244}{2 \times 0.80} + \frac{4500 \times 2.98 \times 0.0484}{2 \times 0.80} = \$814 \text{ per annum}$$

Note: The factor of 0.80 is to account for the increase in the quantity of lamps due to group replacement at 80 per cent of estimated life

Annual material costs:

Since 20 per cent of the lamps are re-usable

$$\frac{4500 \times 60¢}{0.80 \times 2} = \$1685 \text{ per annum}$$

ATC = AMC + ALC = \$814 + \$1685 = \$2499 per annum

Annual saving by this method = \$2980 - \$2499 = \$481 per annum

Group replacement at 30 per cent failure point. The first 30 per cent of lamp failures will be replaced individually and the remaining 70 per cent will be group-replaced.

The mortality curve at this point indicates that the remaining lamps in service have reached 87 per cent of their expected life.

Annual cost of labor:

$$\frac{1350 \times 2.98 \times 0.244}{2 \times 0.87} = \frac{4500 \times 2.98 \times 0.0494}{2 \times 0.87} = \$937 \text{ per annum}$$

Annual material cost:

$$\frac{4500 \times 0.60}{0.87 \times 2} = \$1550$$

ATC = AMC + ALC = \$937 + \$1550 = \$2487 per annum

Annual Saving by this method = \$2980 - \$2487 = \$493 per annum

The framework within which this group replacement program would be conducted is relatively simple. A supply of fluorescent lamps, equivalent in number to a given percentage of the total number in service, would be set aside at some specific location within the storeroom. From this supply, maintenance personnel would replace lamps individually as they failed in service. When this store of lamps became exhausted, the time would have arrived to replace lamps by groups.

Obviously, some of the lamps that are removed have

Table II. Replacement time in hours to change a single lamp

Operation		Base Minutes
Electrician arrives at work location after call		4.10
Locates defective lamp and places new lamp down		0.60
Obtain and transport ladder to work area		0.45
Set-up ladder in aisle		0.40
Position ladder over bench under fixture	0.50	
Climb ladder, remove lamp, descend	0.47	
Climb ladder, wipe fixture, descend	0.88	
Climb ladder, insert new lamp, descend	0.66	
Sub total per fixture	2.51	
Move ladder to aisle, rearrange trucks and chairs		0.58
Close ladder and lower on side		0.50
Carry ladder to storage area		0.48
Return used lamp to maintenance building		3.15
Constant		10.26
One Lamp × 2.51		2.51
Time per lamp		12.77
Time per lamp with five per cent general allowance		13.40
Base hours per lamp[1]		0.244

Note 1. Calculated on the basis of 55 working minutes per hour

Table III. Study of group replacement time in hours per lamp

Operation		Base Minutes
Carry 20 lamps to fourth floor of plant		3.15
Obtain and transport ladder to work area		0.45
Set-up ladder in aisle		0.40
Position ladder over bench under fixture	0.50	
Climb ladder, remove two tubes, descend	0.76	
Climb ladder, clean fixture, descend	1.93	
Climb ladder, insert new lamps, descend	1.01	
Sub total per fixture	4.20	
Move ladder to aisle, rearrange trucks and chairs		0.58
Close ladder and lower on side		0.50
Carry ladder to storage area		0.48
Return used lamps to maintenance building		3.15
Constant		8.71
10 fixtures × 4.20		42.00
Total time		50.71
Time per lamp		2.53
Time per lamp with five per cent general allowance		2.66
Base hours per lamp[1]		0.0484

Note 1. Calculated on the basis of 55 working minutes per hour

Fig. 9. Office area used in developing the study on lamp replacement and fixture cleaning shown in Tables I and II

some remaining useful life, so out of these, the lamps to be used for individual replacement for the next cycle are selected. It is evident that, as progress is made and as empirical data is accumulated, the point can be determined at which it is most economical to group replace. Manufacturers have indicated that, in general, the best operating point lies between 20 and 30 per cent of failures.

The annual savings of the preceding study are as follows:

10 per cent failure point = $147
20 per cent failure point = $481
30 per cent failure point = $493

It may be seen from supporting data that the introduction of an effective program of group replacement for this particular plant would result in an annual saving as high as $493 at the 30 per cent failure point. Note that considerations other than labor and materials have not been introduced. It is quite possible that a reduction in lumen output due to dirt accumulation could be an important factor here.

One of the most important underlying factors here is the ability to reduce the overall labor requirements by resorting to group lamp replacement methods. The results of an actual study in the field are presented to illustrate the nature of the factors involved.

The study shown in Table III was conducted by the author to determine the time required to group replace a typical bank of fluorescent lamps in ceiling fixtures mounted 12 ft above floor level on the fourth floor of a manufacturing building. The maintenance electrician began the cycle with twenty lamps at the second floor storeroom of the adjacent maintenance building.

The results given in Table II indicate labor requirements for the replacement of the same lamps on an individual basis. The study was begun by paging the maintenance electrician and requesting lamp replacement.

The study is self-explanatory and little more constructive material can be added, but one point seems quite clear viz., that few managers can afford the luxury of single lamp replacement methods.

It takes very little imagination to come to a realization that the light intensity of a system depreciates over time. As we mentioned earlier, the causes[8] are aging of the lamp and accumulation of dirt on lamps and fixtures.

The author conducted an investigation on this subject (See Fig. 9) in the office of a manufacturing plant to accumulate data and to obtain knowledge of the relative importance of replacing lamps, and cleaning. The results of this study were quite revealing.

A series of twenty-seven individual light readings were taken of each of the conditions shown in Table IV.

For purposes of comparison, the value of 60 ft-c, shown in Table IV, was obtained from readings with clean fixtures and new tubes and was selected as the maximum intensity available. The readings, taken with uncleaned fixtures and uncleaned tubes, (average life estimated at 5000 hr) showed that the light intensity had diminished to 66 per cent of its original value.

Replacement of the old tubes with new tubes without cleaning the reflectors raised the average intensity to its original maximum value. Old tubes were inserted into the fixture after cleaning the reflectors and this produced an increase of only four per cent above the minimum reading.

The above data indicates that this fluorescent fixture which has slots in the top of the reflector requires very little cleaning because it permits normal air circulation[9] to keep reflecting surfaces clean.

Cheap Lamps May Be Expensive

As with any other piece of equipment in a plant, the quality of the lamp plays an important role. This is frequently overlooked by many managers who are interested only in the material cost of the lamp itself. In order to determine whether any real difference existed, one interested user conducted a study of the lamps of two different manufacturers that were in current use on their premises. It illustrated conclusively that there were decided differences in economy.

Going into the details of this study, we can label the lamp manufacturers as "A" and "B".

One of the underlying reasons for conducting this study was the receipt of comments from maintenance electricians about the "dirty pins" found on lamp "A". Personnel also commented on the greater maintenance difficulty with "A" lamps than with "B" lamps.

[8]Article—$24,500 Worth of Light for a Net Cost of $144. Textile World, March, 1954, Richard B. Pressley.

[9]Light Magazine—The Industrial Lighting Look—1954, Vol. 23, November 3, 1954.

Table IV. Effect of dirt and aged tubes on lumen output

	Intensity	Per cent of Maximum
Clean fixtures with new tubes	60 ft-c	100
After 5000 burning hours	40 ft-c	66
New lamps in dirty fixtures	60 ft-c	100
Clean fixtures with cleaned old tubes	43 ft-c	70

Note: Fixtures mounted 11 ft 8 in. above floor; reading taken at desk top level, 30 in. above floor

It was then decided that data should be kept on all costs associated with both lamps in an attempt to determine any differences which might result from quality variations of the two. This data was accumulated over a period of almost one year and it is summarized in Table V.

It was determined that the maintenance service described in Table V was performed at an average rate of eight man minutes per lamp at a cost of $0.56* per lamp. A thorough analysis of 1000 lamps was made. The results show in Table VI.

* The material used by the author was obtained from many different sources and therefore the reader should keep in mind that the labor wage rates used in various parts of this article are not necessarily uniform.

Tables V and VI clearly indicate that variations in the quality of lamps cause a considerable variation in overall maintenance cost. It should be noted that although in this case lamp "A" happened to be purchased for $0.09 less than lamp "B" it actually cost $0.10 more per unit over a period of time.

This should serve as a clear warning to those of us who would attempt to resort to short cut methods of cost determination.

And—In Summary

Throughout this article, a sincere attempt has been made to provide the plant engineer with some knowledge of the important factors that should be taken into consideration in the formulation of an intelligent lighting policy.

Our analysis of industrial lighting was divided into four major categories which are considered by the author to be most significant;

(a) The problem confronting the manager
(b) Effects of lighting upon worker efficiency
(c) Factors to be considered when selecting a system
(d) Considerations involving maintenance

We began our discussion of the problem by emphasizing the importance of having a broad knowledge of the subject of lighting. Intimacies with technical details are unnecessary for the busy plant engineering executive; he may refer to technical advisors for this. He should remember, however, that the quantity of light required is best determined by the difficulty of the visual task and that there is a definite relationship between the amount of human energy expended in the performance of a task and the light intensity on the work, all other things being equal.

We have attempted to illustrate that increases in both productive quality and quantity accompanied lighting improvements. Data supporting this view are becoming increasingly abundant.

An attempt was made to illustrate that expenditures for adequate lighting may be justified by increases in production and a reduction in rejects and repairs.

Assuming that the importance of adequate levels of illumination was established, we turned to the factors affecting the selection of specific types of installation;

(a) Voltage of operation for lowest overall cost
(b) Selection of the most economical light source

In order to demonstrate a method for use in selecting a system with the greatest economies, a series of calculations was presented in Table I. Here we found decided differences in the cost of systems that were seemingly similar. It is quite evident that investigations should be conducted to determine the overall costs of each proposed system before any selection is attempted.

The life of fluorescent lamps is shortened by excessive starting and stopping operations. Where lighting is required for short periods, incandescent lamps will often prove to be more economical. One may determine whether savings are possible by introducing proper values into the equation provided for that purpose. An arbitrary decision should be avoided.

The last major subdivision was dedicated to maintenance considerations. Conclusions should be drawn that real diseconomies can appear when lighting system maintenance is not taken seriously. First of all, the engineer must anticipate the quality of maintenance and compensate for it in his original design. Poor maintenance means a greater capital investment in fixtures. In addition to this, insufficient attention results in reduced luminaire efficiency which means a waste of electric power.

For optimum results, a group replacement and cleaning program should be set-up as described and faithfully adhered to. Cost consciousness is obviously a necessary ingredient in every facet of business activity. An alert plant manager would consider absurd the selection, promotion, production and distribution of a commodity without a meticulous cost analysis. Yet at the same time he might overlook the benefits of adequate illumination.

Table V. Study of "What's wrong" with lamps of two makes

	Lamp "A"	Per Cent	Lamp "B"	Per Cent
Total lamps used	2,372		654	
Total lamps requiring service	723	30.5	105	16.1
Divided as follows:				
Burnouts	368	15.5	64	9.8
Poor electrical contact	199	8.4	30	4.6
Starter reset	156	6.6	11	1.7

Table VI. Difference in cost per thousand of two lamp types

	Lamp "A"	Lamp "B"	Difference
Labor costs[1]	$170.80	$90.16	$80.64
Lamp costs[2]	94.68	69.50	26.18
Excess cost of Lamp "A"			$106.82

Note: 1. Percentage of 1000 lamps at $0.56 per lamp (See line 2, table V)
2. Cost per lamp X per cent burnouts (Table V) Lamp "A" $0.61—Lamp "B" $0.70

These articles have been confined to the economics of industrial lighting because of space limitations. It is not intended that the treatment of this material should convey an impression of cost as the prime consideration. One cannot over-emphasize the need for a well balanced design which includes the overall factors of quality and visual comfort.

I would like to acknowledge the many suggestions and help afforded to me by various Western Electric individuals, especially M. R. Chandler and C. W. Ketchen. **End**

Airborne Coffee Beans

They "Fly" Across Street from Storage to Roaster

By **EJGIL RASMUSSEN**, Plant Engineer, J. F. G. Coffee Co., Knoxville, Tenn.

COST OF CONVEYING green coffee beans between warehouse storage and processing in another building has been cut by 50 per cent at the J.F.G. Coffee Company, Knoxville, Tenn. The improvement was made by installing an air conveyor system.

The old handling method was inefficient and costly. One hundred-thirty-pound bags of beans, stored on pallets in the warehouse, were loaded onto a small trackless train which carried them across the street; once inside the processing building, each car of the train had to be taken by freight elevator to the fifth floor where bags were piled up next to the roasters; when needed, beans were dumped from bags into the blenders from which they were discharged into roasters.

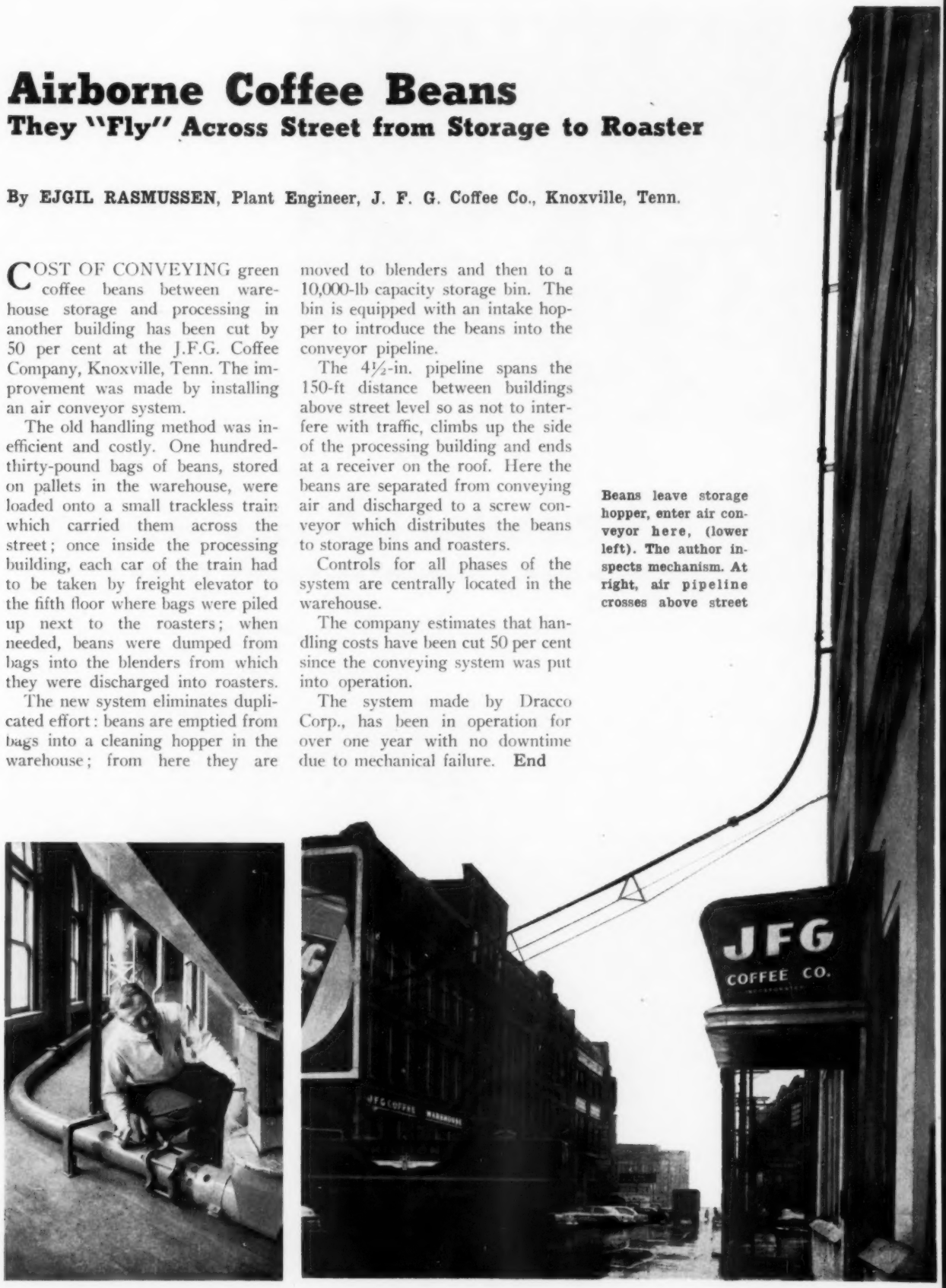
The new system eliminates duplicated effort: beans are emptied from bags into a cleaning hopper in the warehouse; from here they are moved to blenders and then to a 10,000-lb capacity storage bin. The bin is equipped with an intake hopper to introduce the beans into the conveyor pipeline.

The 4½-in. pipeline spans the 150-ft distance between buildings above street level so as not to interfere with traffic, climbs up the side of the processing building and ends at a receiver on the roof. Here the beans are separated from conveying air and discharged to a screw conveyor which distributes the beans to storage bins and roasters.

Controls for all phases of the system are centrally located in the warehouse.

The company estimates that handling costs have been cut 50 per cent since the conveying system was put into operation.

The system made by Dracco Corp., has been in operation for over one year with no downtime due to mechanical failure. **End**



Beans leave storage hopper, enter air conveyor here, (lower left). The author inspects mechanism. At right, air pipeline crosses above street

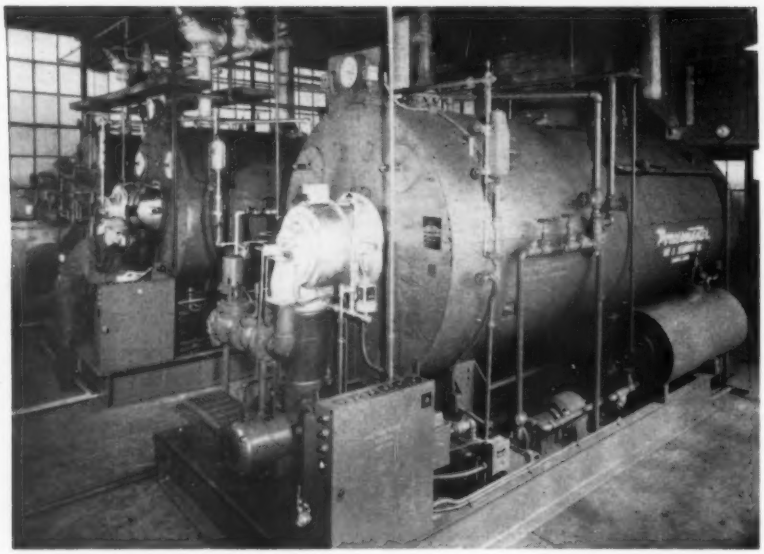


Fig. 1. Three packaged boilers make up boiler plant supplying heating steam. Operating crew has been reduced to one man per shift, from four per shift formerly required for boiler plant

Old Boilers Fighting a Losing Battle?

How One Plant Won Steam Demand Vs. Supply Problem

By MARION A. SMITH, Plant Sup't., Canning Machine Div., Food Machinery and Chemical Corp.

STUDY of the experience of the Canning Machine Div., Food Machinery and Chemical Corp., located in Hoopeston, Illinois, provides an example of a company improving its ability to meet its multi-purpose steam requirements.

At the plant, the steam problem was complicated because of the varying needs in different sections of the plant. For example, in addition to steam needed for worker comfort generally, constant but different temperatures had to be maintained in various plant sections for quality control purposes.

Difficult Heating Conditions

The company, a major manufacturer of food canning and processing equipment, had operated with coal-fired boilers until 1946. Results were inadequate, however, to provide heat under such conditions as these: half the wall area of the plant's 32-ft high bays is glass; a 27-ft roll door on the truck dock and three 20-ft roll doors elsewhere in the building are opened at least 25 times each day; the machine shop, where a tolerance of 0.0001 in. must be held, demands a constant 65 F temperature; the foundry and the boiler shop require 50 F, while the pattern shop needs 70 F.

Aside from being unable to provide the constant steam needs of these areas adequately, the coal-fired boilers could not cope with sustained cold spells of ten degrees below zero, and overnight temperatures of twenty degrees below.

As an alternative heating method for supplying their needs, the company turned to package automatic boilers. The coal stokers were replaced with a 150-hp Powermaster packaged automatic boiler, provided by Orr & Sembower Co., Reading, Penna. The first unit was installed in 1946; the second, in 1949 and a third—this one with a continuous modulation burner—went into operation in 1955.

Studies made since the Powermaster installation show that fuel costs would be approximately the same with either coal or oil; but by using the oil-burning boilers, labor costs have been reduced to give a saving of $340.00 a week. Also, because of the plant expansion program underway, the coal-fired boiler was in critical need of an additional stoker and boiler.

The problem of cold air blasts entering the plant when the roll doors are opened has been offset by the new boiler installation. The automatic features of the boiler allow it to adjust rapidly to these sudden changes in temperature, responding to the thermostatic controls in the shop areas.

The installation of the first packaged unit reduced the need for boiler room personnel by 75 per cent. The old stokers required four men per shift on duty 24 hours a day; today the plant's three boilers require the attention of only one man per shift.

Fuel Consumption Comparison

The packaged automatic units have been an asset from the standpoint of fuel consumption. The three units consume only 50 gal of No. 5 fuel oil per hour, compared to ¾ tons of coal formerly used to provide the same heat level.

Much of this is due to the plant's newest boiler, which operates on a

continuous modulation burner. Plans are underway to convert the other two units, which are the high-low fired type, to this new firing method which has proved more efficient.

With the liquid fuel being stored in an 18,000-gal underground tank, the plant areas previously used for coal storage are now available for production storage.

Actual installation and conversion to the O&S boilers was accomplished swiftly, each installation requiring only 48 hours. No foundations, brickwork or masonry were needed. The packaged units were set down on an eight-inch-thick concrete floor, and connected to the stack and to the steam, water, oil and electrical lines.

Two Condensate Return Systems

When the first packaged automatic boiler was installed, the company had to coordinate an outmoded condensate return system with a new gravity return type being installed in new additions to the plant. As shown on the floor plan, Fig. 2, the north end of the plant has one condensate system, and the south end has another.

In the old system, serving the north end, the condensate is returned by vacuum lines to the distributing head and then pumped to the main storage tank in the boiler room. In the new system located in the south end of the plant, the condensate is returned by gravity to four small collecting tanks and then pumped from these tanks to the main storage tank. Thus, all the condensate is collected at one point for makeup.

Steam is carried from the boilers at 95 psi through six-inch welded pipe to a distributing head at the center of the plant. At this point, the steam is reduced to 15 psi for piping throughout the system.

Major heating in the plant is by downdraft, thermostatically controlled heaters. From four to seven blowers are controlled by a single thermostat, providing draft protection from one part of the shop to another. Blowers are spaced at intervals of approximately 800 sq ft.

With two 10-hour shifts in the plant, Food Machinery & Chemical Corp. uses its packaged boilers around the clock, the full load coming between 6 and 10 A.M. It cuts back to two units, and later to one, as the heat level in the plant rises during the day. **End**

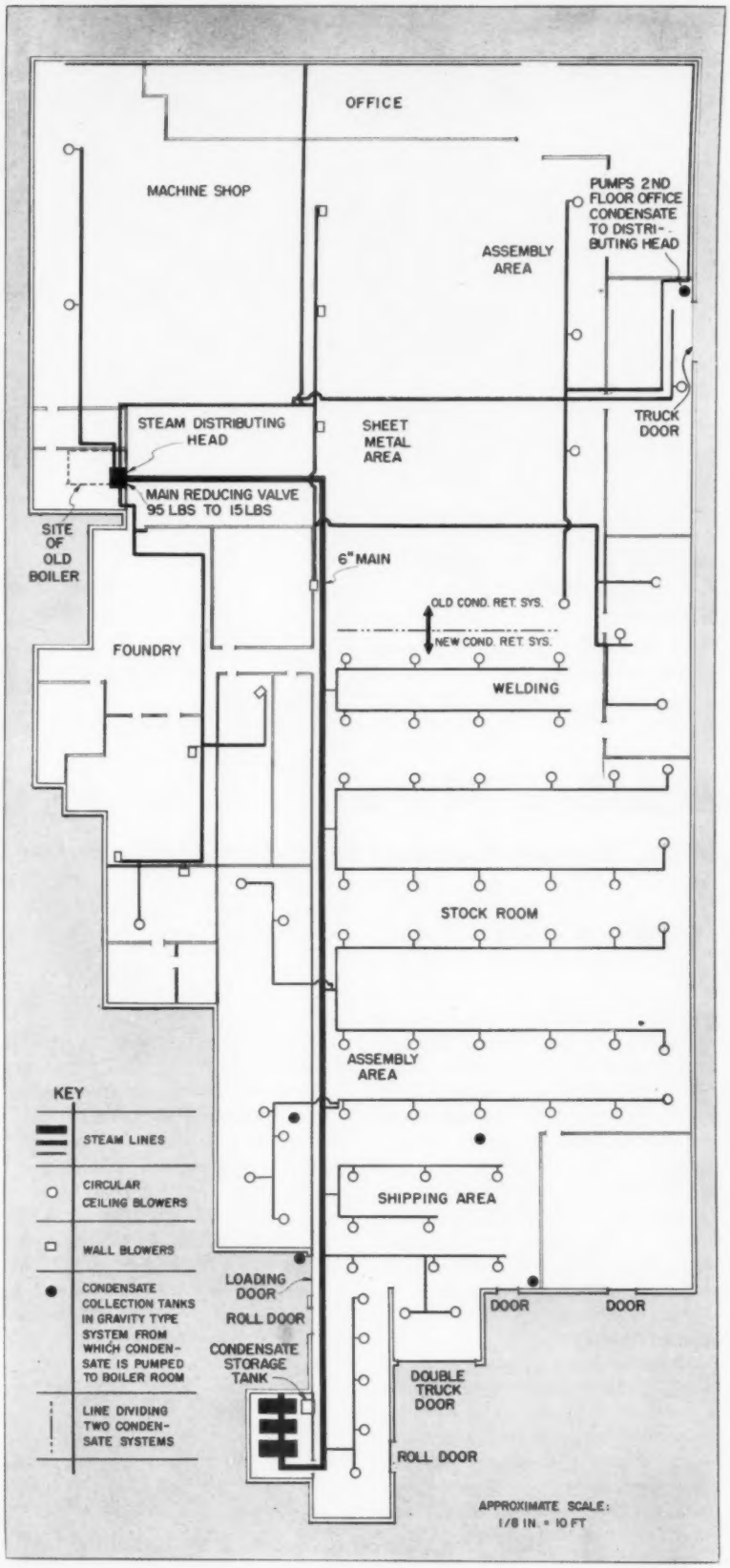


Fig. 2. Floor plan of building shows heating lines and relocation of boiler room

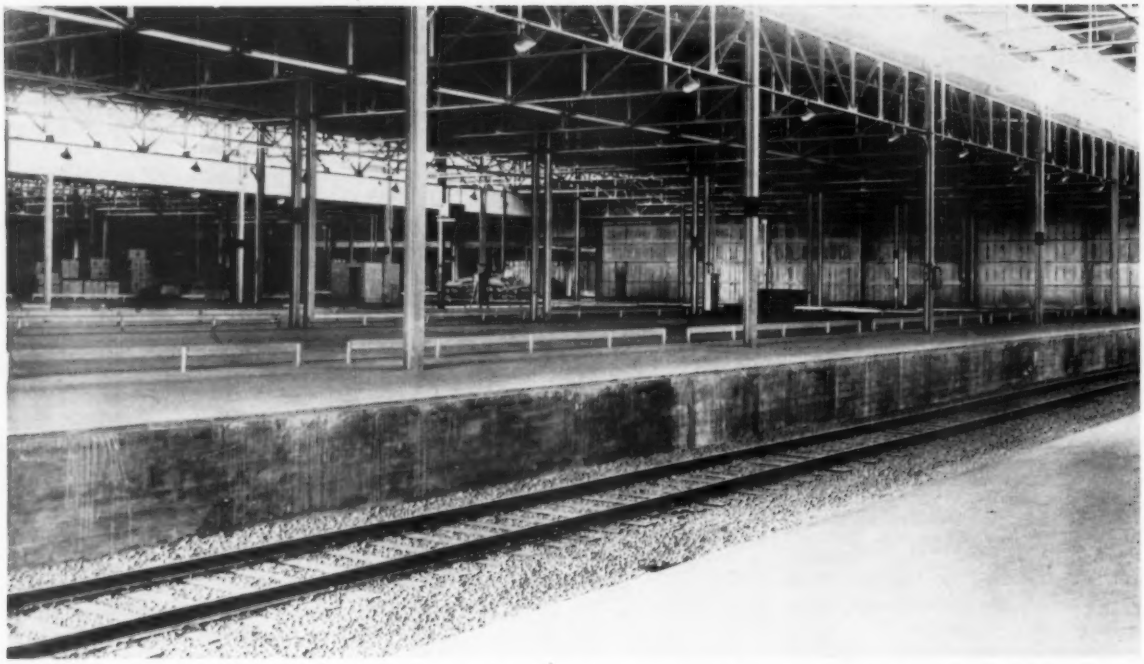


Fig. 1. A metallic iron and concrete floor was applied to the shipping area of this meat and food refrigerator depot. For best results, the application should be handled by workmen familiar with scattering metallic iron over fresh concrete

Adding Metallic Iron to Concrete?

If So, Proper Control and Application Are Important

By LEO LIBERTHSON, Technical Director, Building Products Division, L. Sonneborn Sons, Inc.

IRON REDUCED TO particle size and used as a specific adjunct in a concrete mix imparts useful characteristics to a concrete floor finish. Some of these characteristics are thermal and electrical conductivity as well as durability.

To receive these benefits, it is important to see that the metallic iron is properly applied to the fresh concrete. If it is not done correctly, or at the proper time, then you are losing most of the value from this type of flooring.

The material in the package is one thing; its behavior after installation is another. That is why a successful installation is one that is executed by skilled and experienced workers. They should know how to work with fresh concrete and also be skilled in scattering the metallic iron over the concrete.

To best understand this, it might be well to explain what actually takes place when fine iron aggregate is applied to freshly laid concrete floors. The material is mixed with cement, scattered over the freshly laid concrete surface, at the right time, then floated and trowelled in. The more you scatter into the surface, the closer together are the metal particles. In fact, if you use enough, you will wind up with practically a continuous metallic surface. After the proper drying period, the floor is then ready to be put into service.

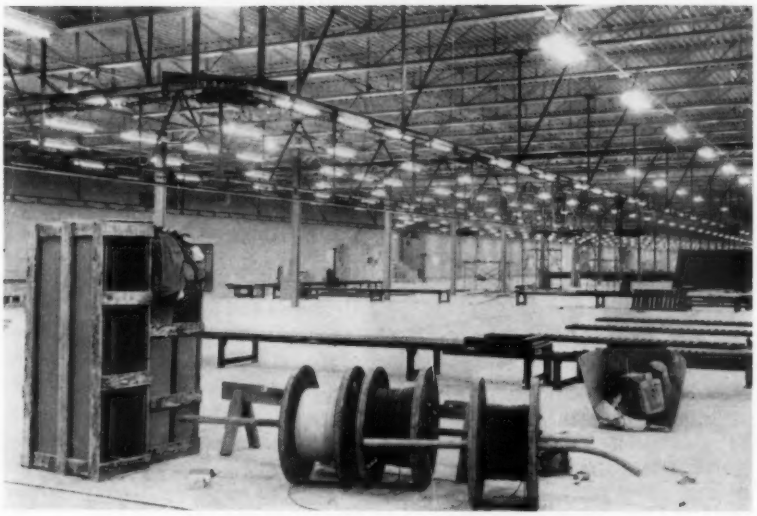
Timing Is Important

However, if there is a hurry to finish the job at an arbitrary time, the metal may be scattered too early. With the presence of a lot of water on the surface, the metal particles will sink below the floor surface. In an effort to secure a good finish, the metal will be buried still deeper by the float or trowel and the end result will be far from expectations.

On the other hand, if the metal is distributed after the concrete has already acquired an initial set or is well on the way to acquiring it, a prohibitively excessive proportion of the metal will be poorly imbedded and poorly bonded. Eventual failure will manifest itself as rusting, scaling and spalling.

There is no existing way of mechanically or automatically distributing the metal. Since uniform distribution is a requirement of a first-class job, the man or men who carry out the work should be qualified for good workmanship, and follow the manufacturer's coverage instructions.

Coverage is particularly important because different duties and uses require different concentrations. The



Figs. 2 and 3. Here are two other industrial applications of metallic iron-concrete floors. The top picture is of a foundry in Pennsylvania; the bottom, a warehouse

range commonly used is from 30 to as high as 120 lb per 100 sq ft. With the heavier coverage it is often mandatory to apply this amount in two courses. In such cases considerably greater ease of operation is gained by using an initial set-retardant in the concrete itself so as to gain more time for proper finishing.

Another means of controlling its application is that architects specify or otherwise define the precise finish for a concrete floor. The specifications are based on such considerations as the service to which the floor will be put, the duty which will be imposed upon it, and the industrial environment around floor.

In addition to its use on concrete floors, particled iron is also used for grouting, as in the restoration of foundations, in the construction and installation of concrete supports for heavy machinery and other structural concrete elements.

Another use of particled iron is in hydraulic cement plasters. It is to be noted that in this case, the material is reduced to an almost powdered form to facilitate intimacy of admixture with the cement.

There was a time in the early days when it was not an infrequent experience to find foreign matter in a bag along with particled iron.

Today, the commodity is governed by standards and specifications designed to exclude useless material and to conform to particle sizes in range and mesh analysis which use and experience has indicated to be desirable.

An example of this is the Veterans Administration which specifies the use of metallic aggregate on all heavy duty warehouse construction, and hospital floors. It has established definite specifications for its requirements.

Specifications set down by the Veterans Administration for heavy duty warehouse construction and hospital floors

Retained On	Per Cent
No. 8 Mesh	10 max
No. 16 Mesh	30 max 15 min
No. 30 Mesh	65 max 50 min

Passing Through	Per Cent
No. 50 Mesh	10 max
No. 100 Mesh	5 max

Incidentally, use of metallic aggregate for sparkproofing floors is another thing to consider when specifying floors for your plant. Sparking can be produced mechanically and electrically. The first is generated by the sharp impact of a steel tool hitting a concrete surface. The second is a discharge of an accumulation of static electricity.

In the case of metal striking a concrete floor, there is also present combustible organic matter which burns even faster at the temperature created by the friction.

If the desire is to eliminate sparking such as is created by impact or falling objects, then the answer is not a hard but a soft floor. In fact, this is where bituminous resurfacing comes in or coating with varnishes and sealers.

On the other hand, static sparkproofness entails the element of electrical conductivity. This means that in one way or another, metal becomes a necessary part of the floor design. An example is the use of brass strips in terrazzo floors. **End**

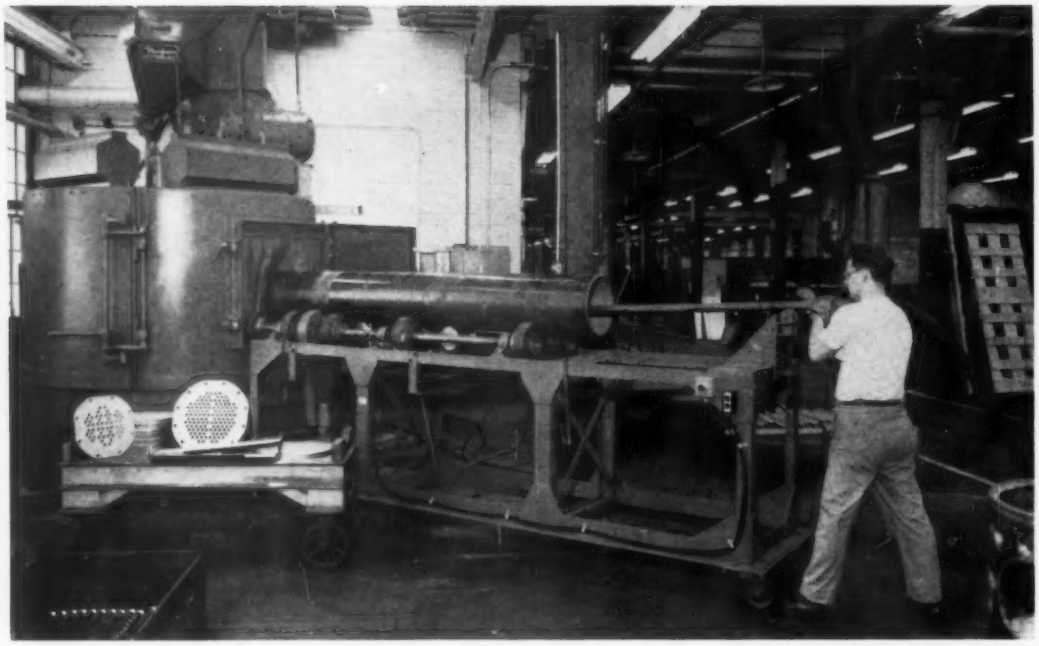


Fig. 1. Portable work positioner and rubber-lined door make it possible to blast clean large condenser shells with standard equipment. As the shell rotates, long nozzle projects the abrasive material at 45 degree angle

Blast Cleaning the Big Pieces

CLEANING large condenser shells at the Sturtevant Division of Westinghouse Electric Corporation, Hyde Park, Mass., has been solved with an integrated all-purpose abrasive blast cleaning installation. It has helped cut cleaning time by two-thirds and substantially reduced handling time.

The plant specializes in manufacturing large commercial fans, blowers and component parts of field assembled air conditioning apparatus. Shells and headers of large Freon condensers for air conditioning units must be thoroughly cleaned before assembly. The condenser shells are approximately 10 ft long and vary in diameter from 12 in. up to 20 in. Airblast is the only practicable way to blast the inside surface of the shells effectively. In the past this process was performed by transporting the shells to a distant blast cleaning station and accomplishing the job in a conventional airblast room.

Now, a six-foot table-room, manufactured by the Pangborn Corp., Hagerstown, Md., installed in the process line serves the dual-purpose of automatically cleaning hot rolled headers, fan components and other parts in addition to serving as a blast chamber for cleaning the inside surface of the condenser shells.

When used as a standard table room, castings are loaded through a single door which opens to expose half of the table. Cleaning of heavy mill scale is accomplished in a few minutes with premium quality chilled iron grit. An integral dust collection and abrasive handling reclamation system ventilates the compartment and cleans the abrasive for continuous reuse.

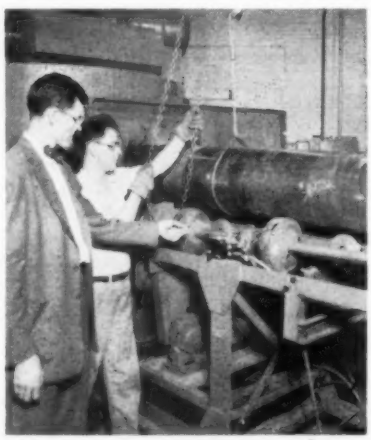


Fig. 2. Lower wheels of positioner facilitate roll-in and are retractable so shell can rotate during blast cleaning

The table-room can be quickly converted to a blast chamber thanks to a smaller, special abrasive-tight door with a heavy rubber curtain which allows one end of the condenser to be inserted into the table-room.

The large condenser shells are loaded by chain hoist onto a portable positioning device which permits handling of bulky tubes by a single operator. After loading, one end of the shell is inserted in the table-room through the special side door. Compressed air lifts move two pairs of the small wheels up under the shell for easy roll-in. After positioning, the rolling wheels are retracted to allow the shell to rest on four pairs of larger wheels which can be rotated during the air blast operation.

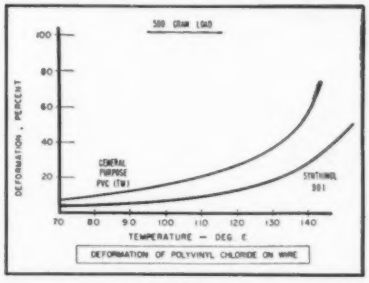
Where it previously required 30 to 35 minutes of actual cleaning time, it now takes about 10 minutes to clean the interior surface of a condenser shell. **End**

Troubled with wiring failures in your plant?

If so, consider the record being established by Rome Synthinol 901, a special 90° PVC compound for wire insulation and sheathing. It has helped to solve an impressive list of difficult wiring problems.

Developed by Rome Cable's laboratory and first introduced in 1949, Rome Synthinol 901 has proved by test and actual use to be superior to conventional PVC compounds in the following ways:

a. Suitable for continuous operation at higher temperature (90°C).
b. More stable under severe heat cycling.
c. Suitable for continuous immersion in hot transformer oil.
d. Superior resistance to chemicals and solvents.
e. Greater resistance to heat deformation.



Graph shows heat deformation vs. temperature, and compares Synthinol 901 with conventional PVC compounds. Test run in accordance with Underwriters' Laboratories standard procedure, except for temperature.

The practical value of this compound can best be illustrated by describing a number of actual case histories.

(1) Oil refinery, industrial and chemical plant wiring.

Plant and oil refinery engineers have long used conventional PVC insulations for plant wiring with good results, but too often heat deformation problems arose in warm locations. Since Rome Synthinol 901's superior deformation resistance suggested that it might be the answer to this problem, it was tried and soon became widely used because of its much better service record.

Synthinol 901 also proved to be far superior to conventional materials for chemical plant wiring where the corrosive action of chemicals and solvents has always been a tough problem. Although polyvinyl chlorides as a class have inherently better resistance to chemicals and solvents than many other materials, some engineers desired even further improvement. One user decided to test a number of samples over a long period by immersing them in various concentrations of acetone, different alkalis, and butyric, propionic, and acetic acids. The results of this careful evaluation showed clearly that, when exposed to these chemicals, Synthinol 901 would last longer than any other PVC tested.

(2) Oil-filled transformers.

Transformer engineers have long sought a cable construction to replace varnished cambric-insulated cable for leads in oil-filled transformers. These leads connect transformer windings and bushings and are constantly immersed in hot oil. One transformer manufacturer, encouraged by successful experience with Synthinol 901 on other applications, undertook a comprehensive study of the possible usefulness of this insulation in lieu of varnished cambric for high-voltage transformer leads. This study extended over a several-year period and proved to those engineers involved that there were at least four reasons for standardizing on Synthinol 901 for this application:

a. There was less sludge in the oil than when VC insulation was used.
b. There was no harmful degradation of the electrical properties of the oil.
c. Conductors insulated with Synthinol 901 ran cooler, permitting a 7% increase in lead cable current rating.
d. The use of Synthinol 901 in lieu of VC would permit substantial dollar savings.

(3) Coil leads.

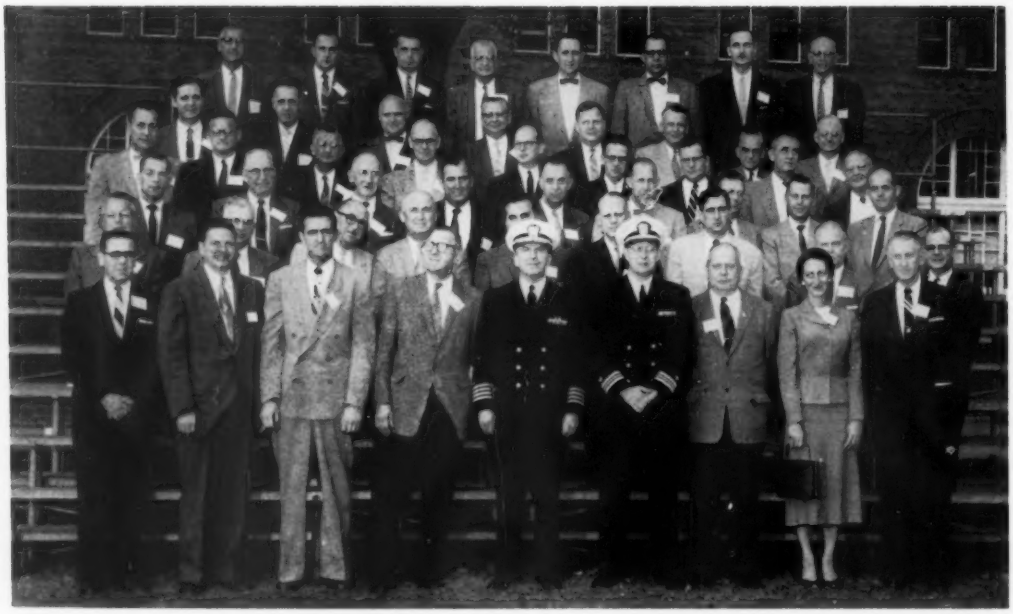
Many manufacturers of small coils for relays, small transformers, small motors, and electronic components have tried to use PVC insulated lead wires for many years. Typically, these leads are crimped or soldered to the ends of the coil; and the whole coil is then impregnated with varnish or wax and baked as long as 16 hours at temperatures as high as 150° C. The varnish used may be asphaltic, phenolic, alkyd, etc.; and the wax may be paraffin, beeswax, carnauba, or another kind.

PVC insulated lead wires frequently produced serious production problems because of the insulation's tendency to shrink, crack, and stiffen during the impregnation and subsequent baking period. Synthinol 901 was substituted in place of the ordinary PVC insulation and, after nearly eight years of wide usage, not a single case of shrinkage, cracking, or stiffening of insulation involving Synthinol 901 has been brought to our attention.

These case histories describe just a few of the applications for which Rome's Synthinol 901 has proved especially effective. Perhaps they will suggest other applications in your own area which might also be better handled with Rome Synthinol 901 instead of a conventional PVC compound. If you have a wire or cable problem that might be solved with Rome Synthinol 901, why don't you get in touch with us? Contact your nearest Rome Cable representative for more information—or write to Department 322, Rome Cable Corporation, Rome, N. Y.

ROME CABLE
CORPORATION

For more facts circle 574 on Reply Card



Members and guests of the Northern Illinois Chapter of the American Institute of Plant Engineers pose for picture during their afternoon tour of Great Lakes Naval Training Station. In the evening, they heard about the Navy's Controlled Maintenance Program and how it pertained to the Ninth Naval District

Activities of Plant Engineers Societies

AS THE NUMBER of Plant Engineers Societies increases so will their activities. Following is a brief report of what some of these Societies are doing:

Northern Illinois

Approximately 50 members and guests of the Northern Illinois Chapter of the AIPE spent a day at the Great Lakes Naval Station, Great Lakes, Illinois, touring the facilities.

At the evening session, guests heard talks by Captain D. E. Carberry, Captain E. E. Gibson and Lt. Comdr. R. D. Mitchell, covering the maintenance-management program as it pertains to the Navy in general and particularly to the Ninth Naval District.

Speaking for industry, Thomas E. Hanson, Editor, PLANT ENGINEERING, presented statistics gathered from a questionnaire recently submitted to plant engineers.

Buffalo

The following officers have been elected to take over the duties of the Buffalo Chapter for the 1957-58 year: M. Ryen, Curtiss-Wright Corp., president; A. J. Smith, Niagara Machine and Tool Works, vice president; N. J. Klipfel, O-Cel-O Div., General Mills, Inc., secretary; and E. J. Waddell, Jr., Pillsbury Mills, Inc., treasurer.

Valley Forge

New officers for the Valley Forge Chapter are: P. G. Damm, Merck Sharp & Dohme, Div. of Merck & Co., Inc., president; C. H. Johnston, Lansdale Tube Co., vice president; and H. I. Hess, Keasbey and Mattison Co., secretary-treasurer.

Mohawk-Hudson

An unusual and most helpful arrangement has been set up by members of the Mohawk-Hudson Chapter. They have what they call the Cooperative Emergency Service which is available to all members.

By mutual agreement, the members stand ready to loan parts needed, suddenly, in hours or on days when the usual replacement sources are closed. This means protection from embarrassing delays and stoppages, and a chance to repair existing equipment instead of having to purchase it new.

Cincinnati

New officers for the Cincinnati Chapter are:

W. T. Straehle, Davidson Chemical Co,. president; W. A. Frondorf, Toms River Cincinnati Chemical Corp., vice president; and R. F. Aerni, Steelcraft Mfg. Co., secretary-treasurer.

New York

Members of the New York Chapter heard an interesting discussion at their November meeting on electronic data processing equipment.

Mr. J. Healy, Physical Planning Consultant for the Eastern Regional Office of International Business Machine and Mr. L. McEwing, Customers Liaison of I.B.M. collaborated in the presentation.

It was an excellent opportunity for plant engineers to get some information on this type of equipment and how it is used in industry. **End**

14 Industrial Cranes
chosen by largest railroad car shop

wall traveling jib crane features maximum hook coverage

This mammoth railroad car shop installed 14 *Industrial* wall traveling jib cranes to obtain maximum flexibility of operation without obstruction of floor space or interference of overhead cranes. Operating singly or in multiples these *Industrial* cranes easily move along the long runway with assembly line load and in effect give infinite number of jib crane installations depending on requirements.

Consult with Industrial Crane & Hoist for practical answers to your materials handling problems.

3-ton capacity with 30 ft. span Wall Traveling Jib Cranes with Hi-carbon steel boom. Cranes operate on six double flange 12" forged steel wheels rolling on two horizontal and one vertical runway.

Industrial CRANES

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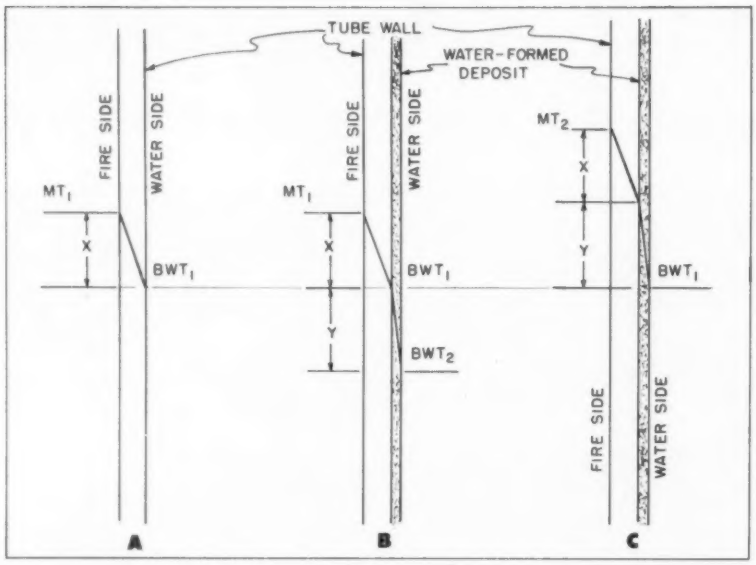
Boiler tube deposits are inefficient, as well as harmful to the tubes themselves . . . Author details why deposit-coated tubes cost you operating dollars . . . As deposits build up, so does the amount of heat that is required



Conditions A, B, and C illustrate effect of progressive deposits on water tube walls

Boiler Deposits

Why They Cost You Money, Efficiency and Tubes

By J. S. BEECHER, Chief Chemist, Power Chemicals Div., E. F. Drew & Co., Inc.

IN THE GENERATION of steam in a boiler, salts precipitating or crystallizing directly on boiler metal surfaces and salts precipitating from solution and then traveling to and baking on boiler metal surfaces may retard the transfer of heat from the fire side of the metal to the waterside to an extent where boiler tube failures due to overheating occur.

The insulating effect of water-formed deposits hinders boiler water in removing heat applied to metal surfaces on the fire side; because of this, some heat may not be absorbed by boiler metal surfaces and pass up the stack.

Scale and sludge deposits may cause several objectionable conditions: boiler metal failures; decrease in boiler efficiency; excessive maintenance. Figure 1 illustrates the effect of deposits on boiler tube metal.

In condition A, heat applied on the fire side of the tube metal at MT_1 temperature travels through the tube metal before it reaches boiler water to maintain boiler water temperature at BWT_1. A temperature drop of MT_1 - BWT_1, represented by X, occurs.

In condition B, deposits resist the flow of heat from the water side of the tube metal to the boiler water. Heat must pass through not only the tube metal but also the deposit, to travel from boiler metal on fire side to boiler water. Therefore, additional temperature drop, represented by Y, occurs and the temperature of boiler water drops to BWT_2. Total temperature drop across tube metal and deposit is MT_1-BWT_2 and is represented by X and Y.

To raise the boiler water temperature from BWT_2 to BWT_1, where it should be under the boiler operating temperature involved, additional heat must be applied to the fire side of the tube metal to overcome the temperature drop caused by the deposits. In doing this, temperature of the tube metal on the fire side increases to MT_2 as shown in condition C. Temperature of the tube metal on the fire side increases by MT_2-MT_1.

Temperature Rise in Tubes

Additional deposit formation will increase Y and therefore MT_2-MT_1. Eventually, MT_2 temperature increases to the safe maximum temperature of tube metal. When this happens, the tube can blister and fail.

Although deposits can result in loss in boiler efficiency, the extent often has been exaggerated. Boiler metal covered with deposit absorbs less heat than deposit-free boiler metal. Although areas covered with deposit absorb less heat, the areas not covered absorb more, with the ultimate result that frequently the overall effect is not as great as previously believed. When boiler efficiency drops, due to deposits, heat not absorbed by the boiler water will go up the stack.

Planning a water treatment program for preventing boiler deposits involves many factors, such as: type of boiler, operating pressure; operating conditions; use of the steam; source of makeup water; quality of makeup water; quality of makeup water required; amount of condensate recovered for boiler use; and type of feedwater heater.

For any boiler, makeup water low in hardness salts, suspended solids, total solids and dissolved gases is desirable.

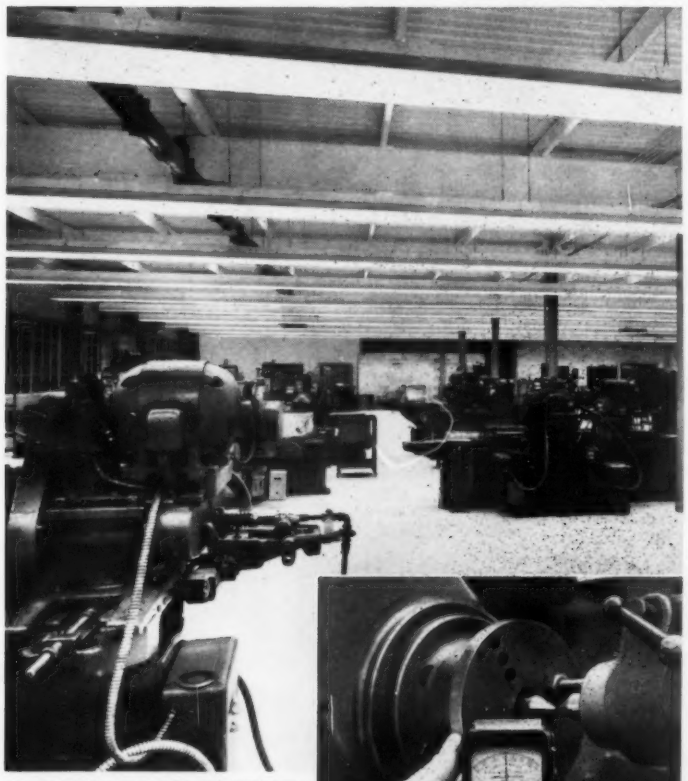
One or more of the factors listed above may necessitate consideration of primary water treating equipment, which may include any of the following:

1. Filtration
2. Coagulation and filtration
3. Aeration
4. Hot lime-zeolite softening
5. Zeolite softening
6. Hot lime softening
7. Demineralization.

Employment of this equipment removes objectionable impurities from makeup water *outside* the boiler. **End**

The Powerful Power-Groove!

General Electric's radical new fluorescent lamp design can give you higher, more economical light levels



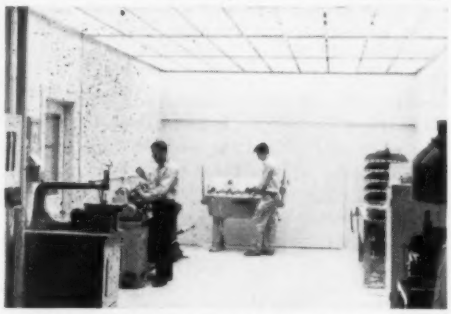
AT ERICKSON TOOL COMPANY (above), 450 G-E Power-Grooves, eight feet long, mounted 10 feet high, with 10 feet between rows, maintain a lighting level of 160 footcandles economically. This means there is plenty of light right at the machines (see footcandle reading at right)—where extra light means extra safety, extra accuracy for workers. No supplementary lighting is needed. Powerful Power-Grooves do it all!

While plans for their new building were still in the early stages, officers from Erickson Tool Company of Cleveland, Ohio, visited the Lighting Institute—General Electric's lamp headquarters at Nela Park. There they saw the whole array of lighting methods and discussed the powerful new G-E Power-Groove Lamps.

They were shown how these revolutionary lamps provide outstanding general lighting, making it unnecessary to use supplemental lighting on individual machines (like that used by Erickson toolmakers in their old plant). They saw how powerful Power-Grooves would fill a plant with pleasant light that's easy on the eyes . . . as well as the pocketbook. The decision was made: Erickson's new plant would have G-E Power-Groove Lamps throughout!

Because G-E Power-Groove Lamps give nearly twice as much light per tube as High-Outputs—2½ times as much as 8-foot slimlines—you can get more light per fixture—with fewer parts to maintain. And compared to other fluorescent systems, you can save 5-20% on your initial investment.

Get the whole exciting Power-Groove story. Write General Electric Co., Large Lamp Dept. PE-18, Nela Park, Cleveland 12, Ohio. Better still, visit Nela Park and let us show you on-the-spot demonstrations of how the powerful Power-Grooves can work for you . . . economically.



WORLD'S BRIGHTEST WORKSHOP—Now you can see powerful Power-Grooves in action . . . lighting the world's brightest workshop. It's at the G-E Lighting Institute at Nela Park. Plan to visit it and see for yourself.

Progress Is Our Most Important Product

GENERAL ELECTRIC

For more facts circle 576 on Reply Card

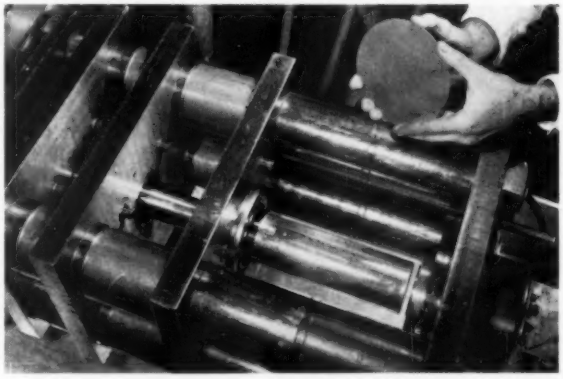
Aluminum Enters Another Field, Deep Drawn To Form Seamless Cans

A NEW DRAWING TECHNIQUE for the commercial production of seamless aluminum cans has been developed by Kaiser Aluminum & Chemical Corp. A commercial prototype can-making facility has been installed at their container plant in Wanatah, Indiana, and is producing on an initial order of 5½ million cans for Kraft Foods.

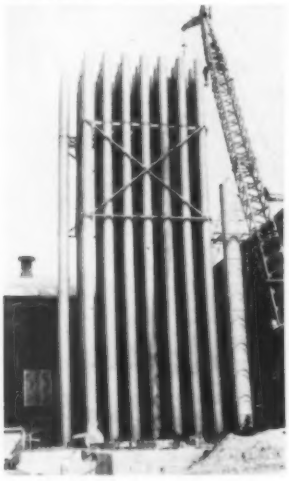
Kaiser has already delivered to the U.S. Air Force its current requirements for aluminum cans for packaging precision bearings and a substantial quantity of cans to Air Reduction Co. for packaging stainless welding rods.

The drawing process produces a seamless can body and bottom in one piece, by advanced techniques for deep drawing sheet. Although it has not been possible, with conventional drawing methods, to perform a greater draw than 50 per cent of the diameter in one stroke, Kaiser's method forms the can body in a single operation. It is now possible, according to Kaiser, to produce seamless can bodies with a depth up to three times their diameter in a single stroke. The technique also makes possible the production of rigid durable cans with walls as thin as 0.005 in.

The Air Force cans were produced by another Kaiser-developed method, which produces cans from coil stock in which one die blanks, forms, trims, sizes and flanges in a single operation. These cans were shallow, with a depth less than their diameter.



Oxygen Stored on End



VERTICAL pressurized oxygen storage tubes, new to the steel industry, will store oxygen at the Granite City Steel Co., Granite City, Ill.

Thirty tubes, rising 80 ft above the ground, were installed by Air Products, Inc. The storage bank will hold 125,000 cu ft of 99.5 per cent purity oxygen.

The steel company has recently installed a 60 million cu ft per month oxygen generator, and the tubes will store this gas under 450 psi, to provide reserve storage for peaks.

Nuclear Sphere Gets "Equator"

GIANT STEEL sphere, to enclose more than 3½ million cu ft, will be built to house the atomic reactor at Commonwealth Edison's Dresden Power Station, 50 miles southwest of Chicago. Major work on the Hortosphere, being erected by Chicago Bridge and Iron Co., is scheduled for completion in early 1958.

A 100-ton derrick, mounted on a 210-ft tower, along with a 170-ft high mast and a boom extending 135 ft, is being used to lift the sphere's steel plate section into place prior to welding.

Quality Control and Metallurgical Research Share Laboratory Space

WEIGHING A PARTICLE as light as a pencil mark or exerting pressure of 150 tons per sq in. on a sample of steel is "routine" at the new Production Metallurgical and Materials Testing Laboratory at Caterpillar's Peoria, Ill. plant.

The new laboratory occupies 22,000 sq ft of office and test space, and employs more than 150 people. Functional design elements include such features as removable steel wall panels, unitized cabinet work areas with stainless steel tops for ease of maintenance, air conditioning and weather control throughout, soundproof fiber glass drop ceilings, indirect lighting, quarry stone flooring in chemical areas and the latest safety devices to protect personnel and equipment.

One of a maze of electronic instruments in the spectroscopy laboratory is a quantometer to make chemical evaluations of steel. An electric arc is applied to a metal sample to produce a white light. A prism within the spectrometer breaks down this light into the colors of the spectrum and permits an extremely accurate analysis of elements present, and their amounts, in the metal sample. The quantometer records these amounts directly on graph paper.

Materials tested in the lab, for quality control purposes, include all types of ferrous and non-ferrous metals, rubber, paint, lubricating oils and concrete.

Hall Industrial Water Report

VOLUME 6 JANUARY 1958 NUMBER 1

By No Stretch of the Imagination

—can one think of getting along in the rubber industry without lots of water. And all the water used for generating steam, cooling, or general service must be conditioned to avoid problems such as deposit formation and corrosion. Undisciplined water can increase costs, hamper production and even shut down the plant. Contaminated waste water must also be cleaned up for disposal.

Hall Engineers are presently working with more than 80 plants in the rubber industry to avoid problems related to water. Whatever your industry, they can help you, too, with their special training and experience in the treatment of boiler water, cooling water, service water and process and waste water.

Careful Control Pays Off

In 1950 Hall staff engineer Len Highley set up the water conditioning procedures for two new boilers to provide steam at 550 psig in an eastern tire plant. Since then operation has been uneventful except for a short period of difficulty with hot-process softener filters and a temporary scare due to soap contamination of condensate. Because of these two events the boilers were acid washed as a precautionary measure early in 1956.

A recent report to Highley reads "We are sorry you were not able to get down to go over our No. 1 boiler, but we thought you would like to know that it was in the same clean condition as No. 2 which you inspected. Our operating people were very pleased and they have noted nothing to cause any concern or question."

This case might be considered just a routine report if we did not "look behind the scenes." There we find the close cooperation between the Hall engineer who prescribes water treating procedures on the basis of his study of the plant and the plant operating men who faithfully and carefully do the important job of maintaining day by day the water conditions which spell success.

Quick Diagnosis

When he collected a sample of the effluent from the hot lime-soda softener at a western tire plant, Hall Engineer John Henricks was surprised to find a noticeable amount of suspended matter in the water. This was unusual because, even though the softened water was not filtered, it had always been remarkably free from precipitated hardness which settled out in the sedimentation tank.

Investigation promptly disclosed that numerous new tire machines had boosted the load on the boilers and softener beyond rated capacities. The increased flow rate had to be maintained, but something had to be done to clean up the treated water to avoid increased chemical consumption in the boilers and abnormal sludge concentration in the boiler water.

Reasoning that a denser and deeper sludge blanket was needed in the softener tank to "filter" the suspended matter from the treated water, Henricks recommended reducing the blow-off from the tank and raising the level of the sludge blanket 6 to 12 inches. With these changes made, the softener water again was clear. But now there was another problem. The hardness of the water was running 0.5 gpg higher than normal. Henricks traced this to inaccurate weighing of treating chemicals and adjustment of slurry level in softener chemical tanks. With careful weighing of chemicals and preparation of slurry, hardness of the treated water ran consistently low at 0.2 to 0.3 gpg.

This is a case where the experience and training of the Hall Engineer enabled him quickly not only to spot trouble in the making but to diagnose the problems and solve them before they caused real trouble.

How to Fool a Deaerator

On his first service visit to a rubber reclaiming plant the Hall field engineer found an arrangement which topped all of his unusual experiences. Chemicals for the low-pressure boiler were fed continuously from two pressure pots with cold zeolite-treated water. The effluent from one pot entered the makeup water line to the deaerator downstream from the flow control valve. The effluent from the other entered the boiler feed line downstream from the deaerator.

Approximately 2000 gpd of water passed through each feeder. At low loads, when no makeup water was required, the cold water flowing into the deaerator from both feeders merely overflowed to the sewer. This also upset heater operation so when the load picked up undeaerated water was pumped to the boiler. The cold, undeaerated makeup water flowing into the boiler feed line continuously introduced dissolved oxygen into the boiler. Finally, at relatively low loads condensate entering the deaerating heater overflowed to the sewer.

By making a few simple piping changes so one feeder could be used intermittently to feed all chemicals, the Hall engineer was able to reduce makeup water consumption from 6000 gpd to 2000 gpd, to cut chemical feed by 75% and to insure satisfactory deaerator operation.

Industrial Water Problems Require Special Handling

There are no "stock answers" to industrial water problems. For information on how the Hall System can help you solve your particular water problems, write, wire or call address below.

Water is your industry's most important raw material. Use it wisely.

HALL LABORATORIES

DIVISION OF HAGAN CHEMICALS & CONTROLS, INC.
HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY, HALL LABORATORIES
IN CANADA: HAGAN CORPORATION (CANADA) LIMITED-TORONTO

Hall Laboratories—Consultants on Procurement, Treatment, Use and Disposal of Industrial Water

For more facts circle 577 on Reply Card

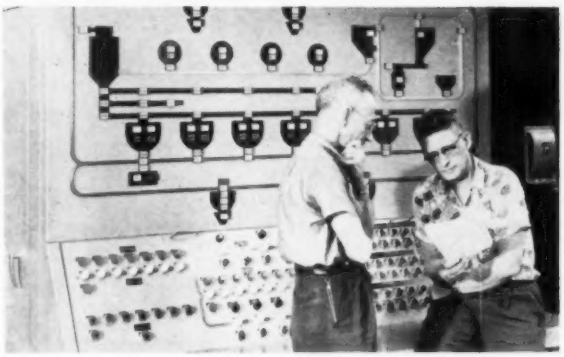
Simultaneous Heating, Pressing of Carbon Blocks Shortens Work Cycle

Now in production at Lawrenceburg, Tenn., a new process cuts manufacturing time of industrial carbon products from eight weeks to less than eight minutes. This highly automated two-step method, developed by National Carbon Co., Division of Union Carbide Corp., forms carbon products in giant presses while high electrical currents simultaneously heat the product to baking temperature.

Heart of the new system is a specially-designed hydraulic press that operates at an average pressure of several tons per square inch. The extreme flexibility of the process makes it possible to change operating pressure, temperatures and cycle timing in varying degrees to produce carbon products with a variety of properties.

A master console controls the entire process, with flow lines and indicator lights reproducing the system on the central panel.

Low-voltage, high-current power transformers with intricate controls supply the current for heating the carbon.



As contrasted to conventional furnace baking, which depends on heat conductivity, and requires several weeks to complete, the new type of heating raises the temperature of the entire mass simultaneously, and uniformly.

Heliport on Shipping Building Provides Quick Repair Parts Service

First emergency shipment to be transported by helicopter from the Westinghouse East Pittsburgh plant's new rooftop heliport was a replacement lightning arrestor for the Illinois Power Co. It was rushed to the Greater Pittsburgh airport for shipment by airplane.

Helicopter service, which includes an eight-passenger vehicle, was inaugurated to provide fast emergency replacement parts service to customers. The "whirlybirds" can handle freight shipments up to 500 lb, carried either between the two landing runners or in hoppers attached to the aircraft's side.

Shipments are made directly to consumers, within a 100-mile radius of Pittsburgh; in other cases, the helicopter carries the load to the airport for transshipment.

The heliport is located on the shipping building roof.

Super-Sensitive Transistors Get Super-Treated Water in Their Bath

In the production of semi-conductors and electron tubes at Western Electric Co., Allentown, Pa., undesirable chemical residues in excess of one part in ten million are intolerable in many operations. A very serious problem is the production and circulation of water pure enough to rinse the germanium and silicon crystals before assembly.

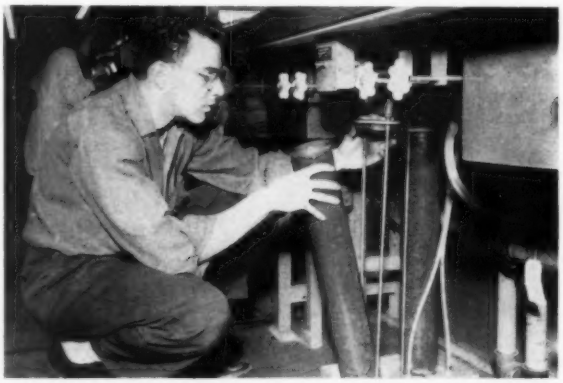
Western considered a number of solutions; first, they considered piping high quality demineralized water through their existing stainless steel lines from a central source, a distance exceeding 300 ft. However, the purified water tended to leach out metallic ions from the pipe and corrosion and organic matter formed at the fittings, so that when it reached the point of use, a minimum resistance of 5 million ohms could not be guaranteed.

Using an approach to produce water of the specified purity at the various points of use, it was decided that this could best be accomplished by "scavenging" already demineralized water received from the central source.

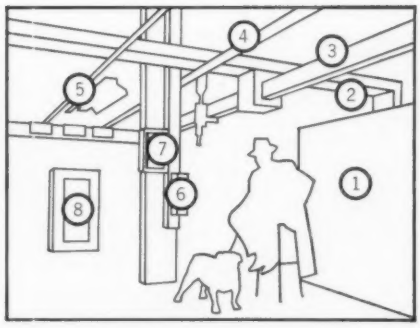
Western Electric and Penfield Mfg. Co., worked out a water-treating system based on secondary point-of-use purification of influent with a resistance of 100,000 ohms or better received from the distribution system. Key to the system is a Penfield mono-column unit containing intimately mixed anion and cation resins. This 40 gph unit is portable and features plastic construction of all wetted parts.

The units will remove any ions remaining in the entering water to bring the resistance up as high as 18 million ohms. Upon continuing use, this resistance will drop until a minimum of 5 million ohms is reached after a time, dependent on the extent of use.

When this point is reached, the resin cartridge is removed and replaced with a fresh cartridge; the spent cartridge is regenerated in a separate device.



Electrical Planning—*key to efficiency and economy, too!*



PLANNED POWER on display—it's yours in a system of coordinated BullDog components. 1. Unit Substation and Unit-Versal® Switchboards. 2. Lo-X® Feeder Duct. 3. Plug-in Duct. 4. Industrial Trol-E-Duct®. 5. Universal Lighting Duct. 6. Pushmatic Electri-Centers®. 7. Clampmatic® Safety Switches. 8. Power Panels.

Score yourself on how well you're using electricity. Is control and distribution of power getting its deserved emphasis in your business? Do you enjoy the benefits of a distribution system tailored to the needs of your operations—whether commercial, institutional or industrial? Such a system, soundly planned by BullDog, can be a giant step toward greater efficiency, profitable use of personnel, and easy, economical growth.

Call on the talents of your BullDog field engineer—let him study your requirements and plan ahead for them. Make sure you are powered up to meet a challenging future. © BEPCO

BULLDOG

BullDog Electric Products Co., Detroit 32, Mich. A Division of I-T-E Circuit Breaker Co.
BullDog Export Division: 13 East 40th St., New York 16, N.Y.
In Canada: BullDog Electric Products Co. (Canada) Ltd., 80 Clayson Rd., Toronto 15, Ont.

For more facts circle 578 on Reply Card

NEW PLANT CONSTRUCTION —advance information on location, costs

Bessemer, Ala.—H. K. Porter Co. Inc., Refractories Division, Alcoa Building, Pittsburgh 19, Pa., plans major expansion of company facilities at this plant. Program will include construction of a new tunnel kiln for the manufacture of fire-brick, installation of new materials handling equipment and new brick-making machinery. Work will get under way at once for completion by early 1959. Major expansion program will cost in excess of $1 million.

El Dorado, Ark.—Monsanto Chemical Co., 1700 S. Second St., St. Louis 4, Mo., plans to construct a new plant for the production of urea. Construction of the plant with a capacity of 100 tons per day will get under way at once and the plant is expected to be on stream by the fall of 1958. New facility will produce urea in both prill and solution forms. Project will represent an investment in excess of $1 million.

Buena Park, Calif.—Kraft Foods Corp., 500 Peshtigo Court, Chicago, Ill., plans to construct a manufacturing plant and an office building with a floor area of approximately 310,000 sq ft. Coordinated Construction Co., 12901 S. Crenshaw Blvd., Hawthorne, Calif., has been awarded the contract reported to be in excess of $3 million. Work is already under way for completion late this year. James M. Fox, 8060 Telegraph Rd., Riviera, Calif., is the architect.

Oakland, Calif.—Kaiser Steel Corp., 1924 Broadway, has started construction work on a large expansion program of company's steel making facilities at Napa, Calif. Expansion, to cost in excess of $2 million, will nearly double the plant's pipe-making capacity and is scheduled to be in production by early 1959.

Richmond, Calif. — Stauffer Chemical Co., 382 Madison Ave., New York, N. Y., plans to enlarge company facilities here for the increased production of pelletized single super-phosphate. Work on the plant is already under way and is scheduled for completion by late summer of 1958. Plant when completed will cost an estimated $350,000.

Denver, Colo.—Bowman Division, United Biscuit Co. of America, North and 25th Avenues, Melrose Park, Ill., plans to construct a large bakery products plant on a 42-acre building site, northwest of here. Ground will be broken soon for the 1200-ft plant which will have three traveling band ovens. Cost reported in excess of $8 million.

Bartow, Fla.—Florida Lightweight Products Co., a newly formed organization headed by W. R. Gooch, Lake Wales, Fla., plans to construct a new plant for the production of lightweight aggregate from phosphate slimes. Construction will proceed at once on the new plant, with an estimated annual production of 80,000 tons. Plant will cost an estimated $300,000 when completed by early 1959.

Savannah, Ga.—Bestwall Gypsum Co., formerly the gypsum and paper division, of Certain-Teed Products Corp., Ardmore, Pa., plans to construct a multi-million dollar plant for the production of gypsum board and lath and other gypsum products as the first phase of an expansion program. Plant will be completed in 1959.

Chicago, Ill.—Kitchens of Sara Lee, subsidiary of Consolidated Foods Corp., 135 S. La Salle St., Chicago, Ill., plans to construct a new bakery products plant. New facility will be a one-story structure with a floor area of 110,000 sq ft. The 40,000-sq ft processing area will be sealed off from outside heat, light, dust and dirt and the filtered air-conditioning unit throughout the plant is intended to reduce impurities and maintain constant, controlled temperature and humidity at all times. Plant reported to cost in excess of $2 million.

Decatur, Ill.—Pittsburgh Plate Glass Co., Glass Division, 632 Fort Duquesne Blvd., Pittsburgh 22, Pa., is building a multi-million dollar window glass plant on local site here. Preparation of the site is already under way and construction of a five-story structure, containing approximately 450,000 sq ft of manufacturing and storage space, will start in the spring of 1958 for completion by spring of 1959.

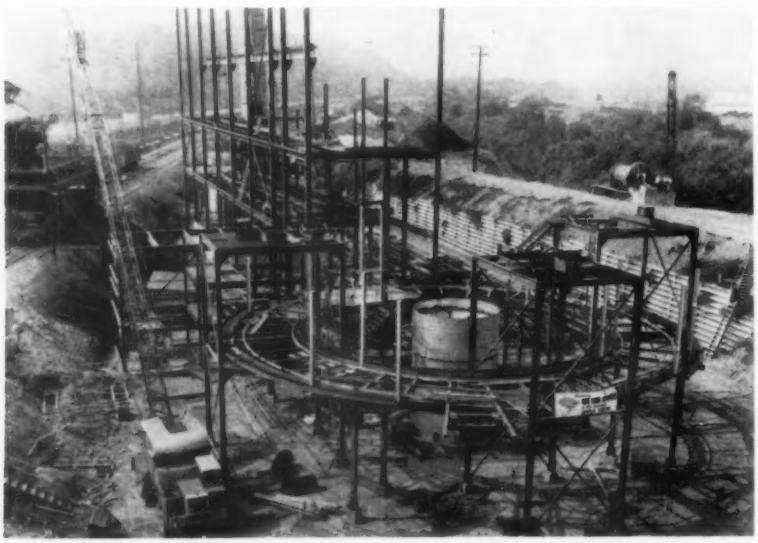
Indianapolis, Ind.—Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill., plans to construct a new bearing plant west of here. Work on the new facility will begin at once. Plant, to be in full production by early 1959, will be a one-story structure about 850 ft long by 400 ft wide with a two-story office and administration building. Construction of the new facility with equipment reported to cost about $5 million.

Mishawaka, Ind.—Bendix Aviation Corp., 400 S. Beigre St., Mishawaka, Ind., plans to add a one-story, 300,000-sq ft manufacturing plant to present company facilities here. Construction contract was awarded to Sollitt Construction Co., 301 S. Columbia St., South Bend, Ind., at a reported cost of approximately $1.8 million. A. M. Straus, Fort Wayne, Ind., is the architect.

Whiting, Ind.—Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago, Ill., plans to construct a crude oil distillation unit at company refinery here. New unit, scheduled for completion in 1959, is being constructed under the supervision of Arthur G. McKee Co., Cleveland, O., contractor.

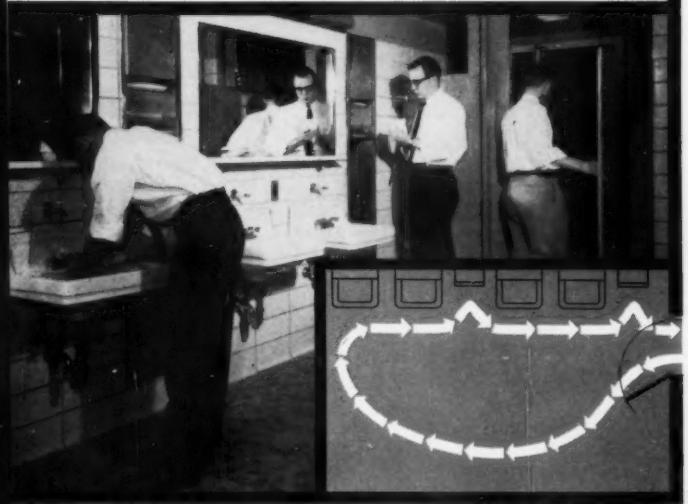
Des Moines, Iowa—Central Soya Co., Inc., 300 Fort Wayne Bank Building, Fort Wayne, Iowa, plans to construct a modern feed plant by its feed division, McMillen Feed Mills, on a 38-acre tract of land. Completion of the

(Continued on page 209)



Scheduled for completion next spring, a new sinter plant for Armco Steel Corp. at its Ashland, Ky., operations begins to take shape. The circular cooler is in the foreground with the main sintering building going up behind it. The new installation, costing more than $5 million, is being constructed by Dravo Corp.

Mr. John K. Nevin, Manager Purchasing Dept., Smith, Kline & French Laboratories, says: "We employ about 2,400 people here. Our recently completed 12-story addition includes 18 new washrooms. SKF designed these rooms to be modern, efficient and streamlined, following Scott principles of washroom planning. The results are fine!"



SKF washroom traffic flows smoothly: washbowls to paper towels (and disposal) to exit. Off-the-floor equipment, recessed cabinets, recessed lighting, scientifically planned soap supply, tile walls and floor—all make SKF washrooms easy to supply, use and maintain. Popular with employees, too!

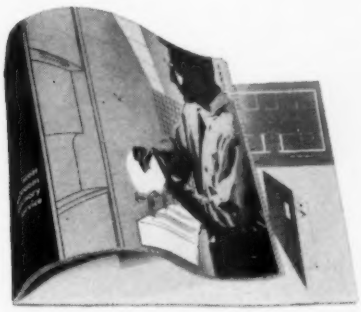
Mr. W. R. Ricketts, Buyer, discusses washroom efficiency with Mr. J. L. Blikle, Project Engineer. He says: "As a manufacturer of pharmaceuticals, it is important to SKF to maintain the highest standards of sanitation. Scott recessed towel dispenser-receptacle looks neat, eliminates litter, helps reduce maintenance costs."

this firm
planned washrooms
for comfort
and efficiency . . .

based on principles of Scott's Washroom Advisory Service

Scott has a free booklet you should read. It's on washrooms and what you can do about them . . . filled with diagrams, illustrations and ideas. It fully explains Scott's Washroom Advisory Service, available to executives. No obligation, of course. Just mail the coupon!

Get Scott's 14-minute film, too. It shows many quick, inexpensive changes you can make *now* to increase efficiency and cut costs!



Scott Paper Company
Department PE-81
Chester, Pennsylvania

☐ Please send me the Washroom Advisory Service Booklet.
☐ Please tell me how I can see the Scott film, no charge.

Name_____

Title_____

Company_____

Street_____

City_____ Zone___ State_____

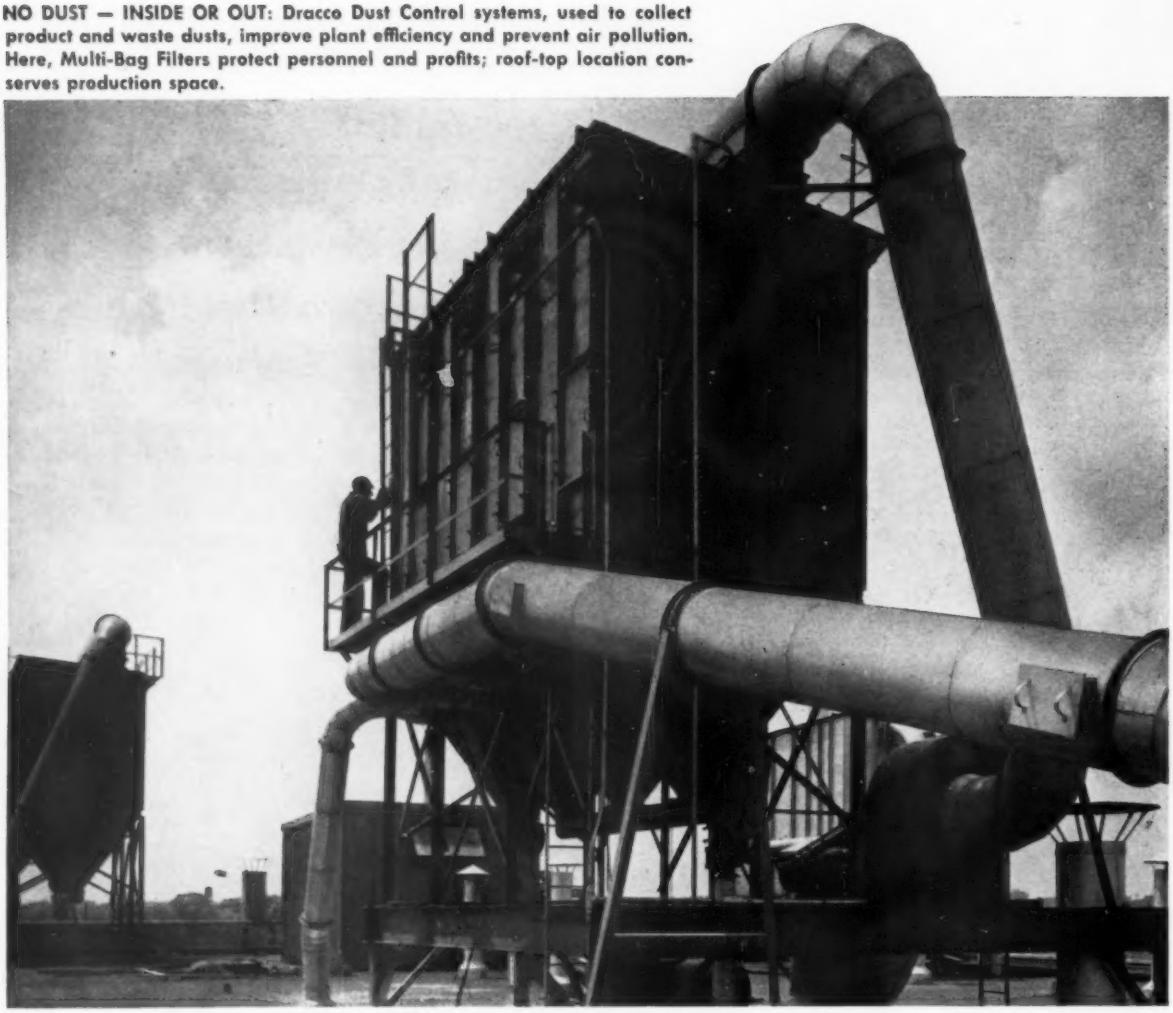
SCOTT PAPER WASHROOM ADVISORY SERVICE

Scott UHA Towels **Scott Multifold Towels**
Scott Singlefold Towels **ScotTissue**

For information on Scott recessed cabinets, write: D. J. Alexander Corporation, 2944 E. Venango Street, Philadelphia 34, Pa.

For more facts circle 579 on Reply Card

NO DUST — INSIDE OR OUT: Dracco Dust Control systems, used to collect product and waste dusts, improve plant efficiency and prevent air pollution. Here, Multi-Bag Filters protect personnel and profits; roof-top location conserves production space.



specify Dracco . . . and forget that dust problem

Dust will cease to be a problem, inside or outside your plant, with Dracco Dust Control Equipment on the job. First of all, Dracco Filters trap the dust at its source before it can become a problem. Then, they collect it efficiently and exhaust only clean air with no visible dust. Finally, they keep doing this year after year with only routine preventive maintenance.

This dependability is built into Dracco equipment through—

simplified design—minimum moving parts, standard components, all parts readily accessible and easy-to-change filter bags assure lowest maintenance cost.

custom engineering—each Dracco system is fitted to exact job requirements for maximum efficiency.

proved techniques—Dracco cloth filtration techniques, perfected over the last 40 years, assure the highest collection efficiencies.

accurate fabrication—heavy-gauge metal and quality materials are skillfully converted into rugged units which provide an extra-long service life.

Solving dust and fume problems is a Dracco specialty . . . and has been for over 40 years. This experience can be combined with that of your plant engineering staff to give you better working conditions . . . improved manpower efficiency . . . lower plant cleaning costs . . . reduced machine wear . . . elimination of air pollution. If dust is your problem, you can unload your worries by contacting Dracco today.

DRACCO CORPORATION
4035 East 116th Street • Cleveland 5, Ohio

Complete 40-page catalog on Dracco Dust Control Equipment contains detailed data and valuable reference material. Write for Bulletin 800.

DRACCO *airstream* conveyors
dust control equipment

For more facts circle 581 on Reply Card

Yes!...it's ALL STEEL

HP RANGE:
½ to 50 hp

RATIOS:
4:1—14:1—24:1 (or 20:1)

OUTPUT SPEED RANGE:
420 to 5 rpm

TORQUE RATINGS:
up to 31,500 lb-in

FALK
ALL STEEL
Shaft Mounted Drive

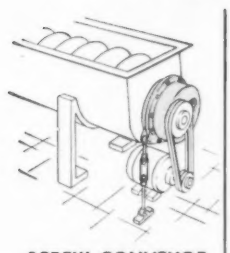
...Steel can "take it"!

STEEL frame ...of fabricated plate supports all rotating elements—provides double the ability of iron to maintain vital alignment of revolving elements, even under shock load or external impact.

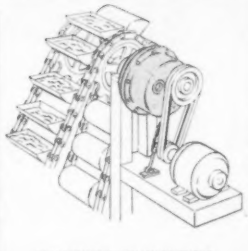
STEEL housing...will not fracture, serves only as protective cover and lubricant reservoir. Therefore, lubricant supply is safeguarded.

STEEL tie-rod and straddle-mounted tie rod brackets...are fastened to heavy steel frame by steel bolts in double shear.

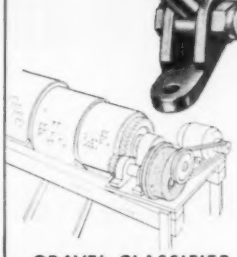
A FEW TYPICAL APPLICATIONS



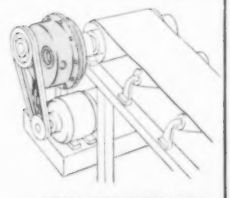
SCREW CONVEYOR



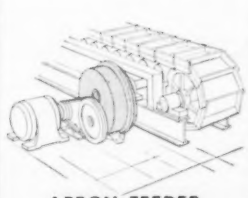
BUCKET ELEVATOR



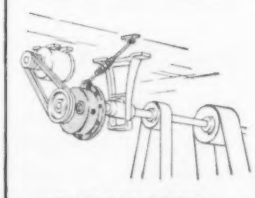
GRAVEL CLASSIFIER



BELT CONVEYOR



APRON FEEDER



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Manufacturers of Quality Gear Drives and Flexible Shaft Couplings

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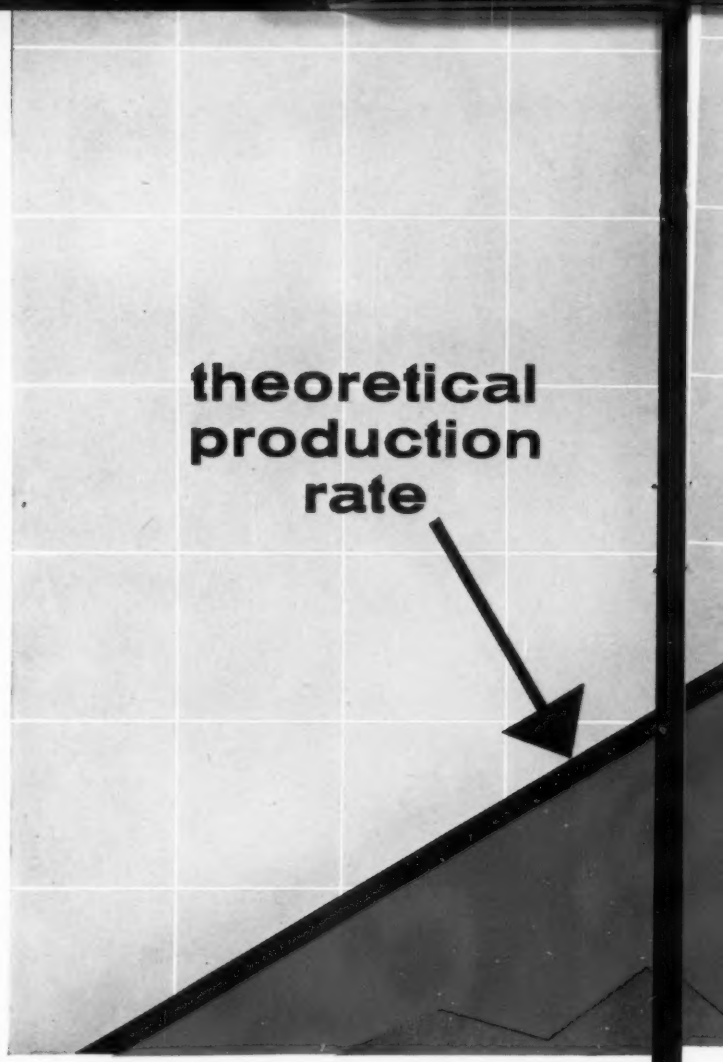


with

Productive Maintenance

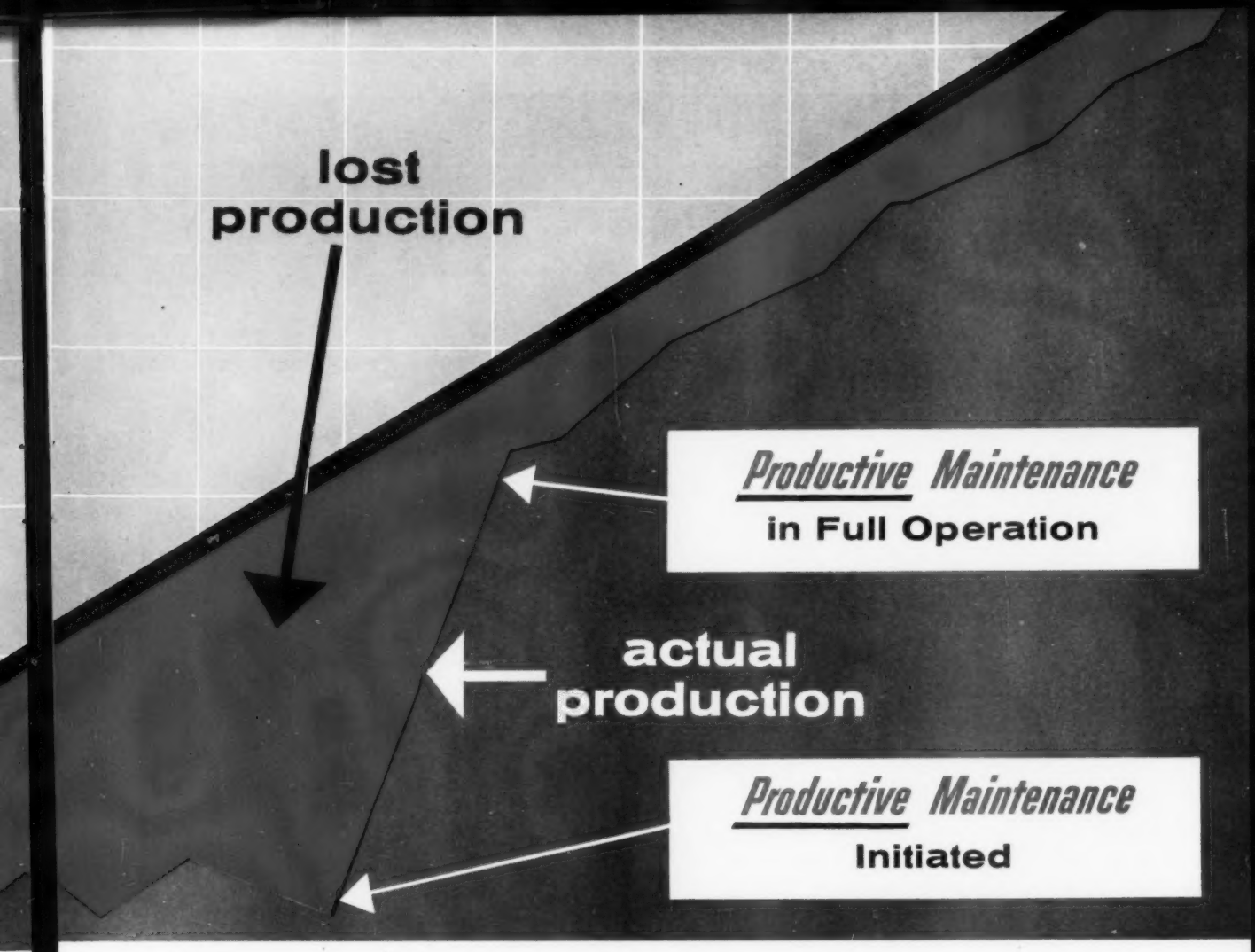
in action

Your Maintenance Can

Unscheduled downtime means loss of production and vital profit dollars—Productive Maintenance helps you plan for profit

MAINTENANCE FUNCTIONS in manufacturing were once considered to be necessary evils burdening the production process. Little attention was given to the proper programming of vital equipment maintenance. Without a planned approach, non-essential production equipment often received too much attention, while important production machinery received too little. Result: high maintenance costs, frequent unscheduled downtime, loss of production.

The competitive requirements of modern manufacturing have brought the maintenance operation into sharp focus. Maintenance is being studied now as a major factor leading to more profitable production. It is being scheduled and implemented in all areas of successful business. One new concept of maintenance programming has received much comment and acceptance from industry. This program, called *Productive* Maintenance, is based on the fact that the maintenance



Become Profitable

function *can* make a definite contribution to a company's profit and production picture. Here's how:

ILLUSTRATED ABOVE is a production-line maintenance chart of a typical company—before and after a *Productive* Maintenance program was adopted. Without a planned approach to maintenance, frequent unscheduled downtime interrupted manufacturing—created a large area of lost production—and prevented the benefits of full production capacity. As mechanization increases, this production loss will be magnified because of the interdependence of manufacturing components.

With *Productive* Maintenance in action, greater utilization of manufacturing equipment was realized. Unscheduled downtimes were reduced and their effect minimized by means of a thorough parts stocking program for all critical production equipment. Maintenance of equipment essential to production was scheduled at convenient times. Production schedules were met, more efficient utilization of trained manpower and machinery was achieved, repair parts inventories were stabilized, and unit production costs were reduced. Altogether, these benefits resulted in actual dollar savings—*maintenance became profitable.*

REGARDLESS of the size of your maintenance problems, it will pay you to check into the advantages of *Productive* Maintenance. For additional information on General Electric's answer to such a program of planned maintenance, contact your nearest G-E Apparatus Sales Office, or G-E Service Shop. They will be glad to provide you with *Productive* Maintenance assistance. Also write for bulletins GEA-6087, 5-steps to Productive Maintenance, and GED-3278, Productive Maintenance In Action, to Section 801-21, General Electric Company, Schenectady 5, N. Y.

***Productive* Maintenance—**
as vital as production itself!

GENERAL ELECTRIC

For more facts circle 582 on Reply Card

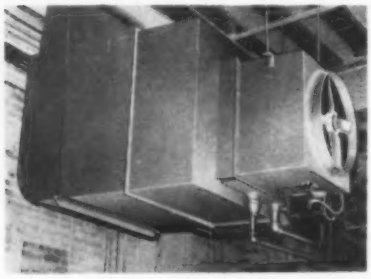
NEW PRODUCTS AND PROCESSES summarized for your convenience

Edited by M. E. Heniken

Use the Reader Service Cards provided on pages 213-214 to ask for more information on these products. Circle item numbers of products in which you are interested.

1—MAKE-UP UNIT supplies, tempers outside air

For tempering outside air and supplying it in sufficient quantities to eliminate negative pressures, this make-up unit supplements the normal heating system by relieving the infiltration heat load. It serves to replace exhausted air with clean, fresh, preheated air. Seven unit arrangements



are offered in six sizes from 24 to 54 in., with air capacities from 4000 to 33,000 cfm. The basic unit consists of a fan and coil assembly with the fan mounted in a plenum on the discharge side of coil. The advantage attributed to this design is an even distribution of air velocity over the face of the coil, and uniform discharge air temperature, resulting from the mixing of air in the plenum between fan and coil. With standard accessories, the unit may be used as a unit heater or source of filtered air for ventilation. Aerovent Fan Co., Inc.

2—LUBRICANT is soluble in water, alcohol and esters

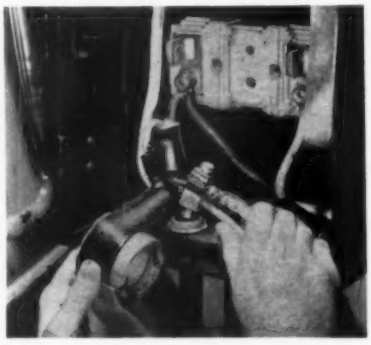
Grezall PI has a number of unusual characteristics. Unlike most greases, company states, it is soluble in water, alcohol and esters. On the other hand, it is reported insoluble in petroleum products: naptha, gasoline, Stoddard solvent, oleum spirits, thinners, mineral spirits and propane. It is also insoluble in chlorinated solvents like carbon tetrachloride, perchlorethylene and trichlorethylene, Freon and anhydrous ammonia. Such characteristics make Grezall PI a valuable lubricant in applications where any of these solvents are used. It is useful, for example, as a lubricant for solvent pumps. It melts above 400 F. Tower Oil Co.

3—CHEMICAL TABLET keeps tanks from rusting out

Rusting out at the bottom of fuel oil and storage tanks can be prevented with Tank No-Corrode, it is claimed. Manufacturer says it works instantly, neutralizing sulphur acids formed when water condensation is trapped, and simultaneously stopping electrolysis and corrosion and preventing leaks; it does not float or clog lines or filters, does not dissolve or react in oil. It comes in tablet form, each tablet pack sufficient to treat a 1500-gal tank. J. A. Sexauer Mfg. Co., Inc.

4—INSULATION COMPOUND cushions irregular shapes

Volseal is an electrical sealing compound in tape form. It is described as an easily-handled, high dielectric insulating material used primarily to seal and build up cable splices. Volseal is claimed to conform to irregular shapes and act as an excellent padding insulator to round out sharp corners around terminals, connections, bus bars and motor lead junctions. The tape comes in rolls 1½ in. wide, 5 ft long, ⅛ in. thick. This ribbon form putty-like substance needs only to be wrapped and shaped into place, to fill and seal



hollows or contour. Once applied, it forms a smooth working surface ready for overwrapping with electrical tape. According to manufacturer, Volseal has an average dielectric strength of 445 v per mil of thickness and is capable of continuous performance at 160 F. Company says it is permanently plastic, won't harden excessively, and is resistant to acids, alkalies. Dutch Brand Div., Johns-Manville Corp.

5—VIBRATION MOUNT consists of adjustable wedges

The Wedgmount combines vinyl-sisal-cork pads with two adjustable wedges to absorb vibration and permit instant leveling by the turn of a nut. Adjustment of nut causes movement involving

two opposing inclined planes, thus raising or lowering machine foot under which mount has been placed. Top and bottom surfaces are pieces of Air-Loc, a vibration-absorbing pad made of vinyl, sisal and cork. When installed under machines, the mounts on either side are placed in opposite directions, cradling machine in opposing planes. Both halves of mount are machined and keyed, to permit vertical adjustment without lateral motion. Compensating-wedge design permits fine leveling adjustments. Mount comes in three sizes to support weights of 1,000, 2,000, and 4,000 lb. Air-Loc Div., Clark-Cutler-McDermott Co.

6—CHEMICAL DE-RUSTER cleans, and protects

Nu-Tex is announced as a chemical de-ruster which prevents rust formation under coats of paint, provides a protective layer without changing size of treated object, and cleans, de-rusts and protects—all in one simple operation without affecting the steel. Rust dissolves quickly, company says, and surfaces may be painted as soon as dried. The use of Nu-Tex is claimed to promote better adhesion and chemical resistance to any paint system applied over it. Nukem Products Corp.

7—PIPE CUTTER for cast iron soil pipes

This lightweight soil pipe cutter claims faster, cleaner and closer cuts on cast iron soil and vent pipe from 1½ to 4 in. Weighing only 7½ lb, the SP4 Cutter is an open-frame four-wheel design which is said to let operator cut 4-in. extra heavy soil pipe in less than ½ min, even in tight corners. A spring tension device serves to provide automatic compensation for out-of-round pipe, chilled spots, seams

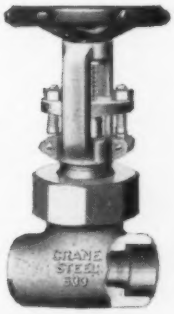
When specifications say "Welded Piping" get everything for the job from CRANE

It is far more satisfactory to get *all* your welding piping materials . . . fittings, flanges, valves, nipples, pipe... from *one* source—CRANE.

Then you're sure of uniform quality. Whether the product is a simple fitting or 24-inch high-pressure, high-temperature valves, Crane controls quality—from raw materials to the finished product.

Each welding type fitting, flange or valve you get from Crane is produced and inspected to established standards—assuring uniform size, wall thickness, and dimensional accuracy—for a good welding job.

One source of supply—from Crane—simplifies ordering, bookkeeping and stock-keeping. Prompt delivery service can be had from Crane's 141 branches, or from wholesalers who serve all areas.



Send for this new Circular of Crane Quality Materials for Welded Piping. Ask for AD-2289.

CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

For more facts circle 583 on Reply Card

NEW PRODUCTS

(Begins on page 168)

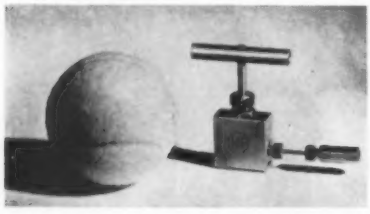
or raised letters and permits clean, right-angled cuts as close as 1 in. from pipe end. Cutter wheels themselves are for use on cast iron soil pipe. They should not be used in any other cutter and cutter should not be used on steel pipe, according to company. Bulletin SP4-31 gives details. Reed Mfg. Co.

8—HEAT TRANSFER CEMENT aids in steam tracing

Thermon T-3 is a fine grained, relatively slow drying heat conducting cement. Its purpose is to fill voids between a vessel surface and an external embossed type plate coil installed for the purpose of heating or cooling the contents of the vessel. Use of Thermon T-3 eliminates heat transfer from the plate coil to the vessel wall through an air gap by providing a path of solid heat conducting material. This increases efficiency of the plate coil system, it is noted. Thermon Mfg. Co.

9—HIGH PRESSURE VALVE is compact in size

Described as tiny enough to fit inside a tennis ball, this high pressure valve is designed for ⅛ in. tubing and handles up to 15,000 psi. The stem is nonrotating type. Valve is available in stainless steel, Monel or Hastelloy and is adaptable for standard compression, socket weld and IPS connections. The capacity of the system, with a minimum of hold-up is claimed ideal for gage lines, instrument, sampling and catalytic injection systems. High Pressure Equipment Co., Inc.



10—DRAFTING MACHINE can be carried in pocket

Draftette is so compact it can be folded jacknife-style to fit in the pocket when detached from its drawing board. It is available attached to a portable drawing board that fits into a briefcase. The unit takes the place of T-square, ruler, protractor and triangles. Draftette is of aluminum construction, black with white-filled numbers and letters of the scale and 180-deg protractor. Draftette can be had

with three sizes of boards. With the smallest, 10 by 13 in., it costs around $6.00. David Miller & Associates.

11—DUAL RECORDER designed to save panel space

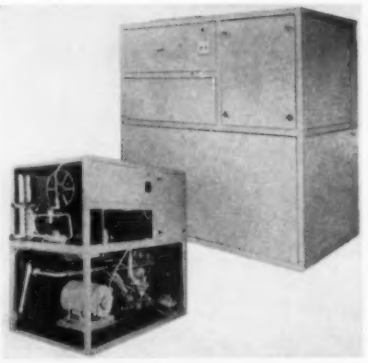
The Twin Recorder consists of two Types CH recorder chart carriages and measuring elements in a single case. The 19 by 16-3/16 in. flange dimensions allow for mounting on a 19-in. relay rack. Design features include 28 chart speeds from ¼ in. per hr to 120 in. per min, a large throw-away plastic inkwell, 150-ft long record rolls and extra hand space inside the case to facilitate maintenance. Chart carriages are driven by a single drive motor located in the right-hand carriage. Separate, double-speed drive motors are provided for chart speeds of 30, 60, 90 and 120 in. per min. General Electric Co.

12—REFRIGERATION OIL has lower floc point

Suniso 3G is announced as an all-temperature oil which works well with all modern refrigerants, including Freon-22, Isotron-22, and Genetron 141. The lower floc point, greater stability, and increased copper-plating resistance of Suniso 3G is claimed to permit more efficient operation of modern refrigeration units. Sun Oil Co.

13—BATTERIES for stand-by emergency power use

These lightweight, space-saving stationary batteries are offered for switchgear, alarm system, control, emergency light and other applications where batteries are used as stand-by emergency power. Available over a capacity range from 40 to 960 amp/hr, the new line of Plante batteries is designed for full float service. A rugged Plastrite jar, lighter in weight than many containers, saves 30 to 40 per cent in floor space, it is announced, and the high impact resistant plastic will not bulge or warp under heat. Among construction improvements announced is a new pot seal which utilizes a soft rubber O-ring in compression to seal the post against possible seepage—to avoid corrosion, wet covers. Gould-National Batteries, Inc.



14—AIR CONDITIONER is self-contained unit

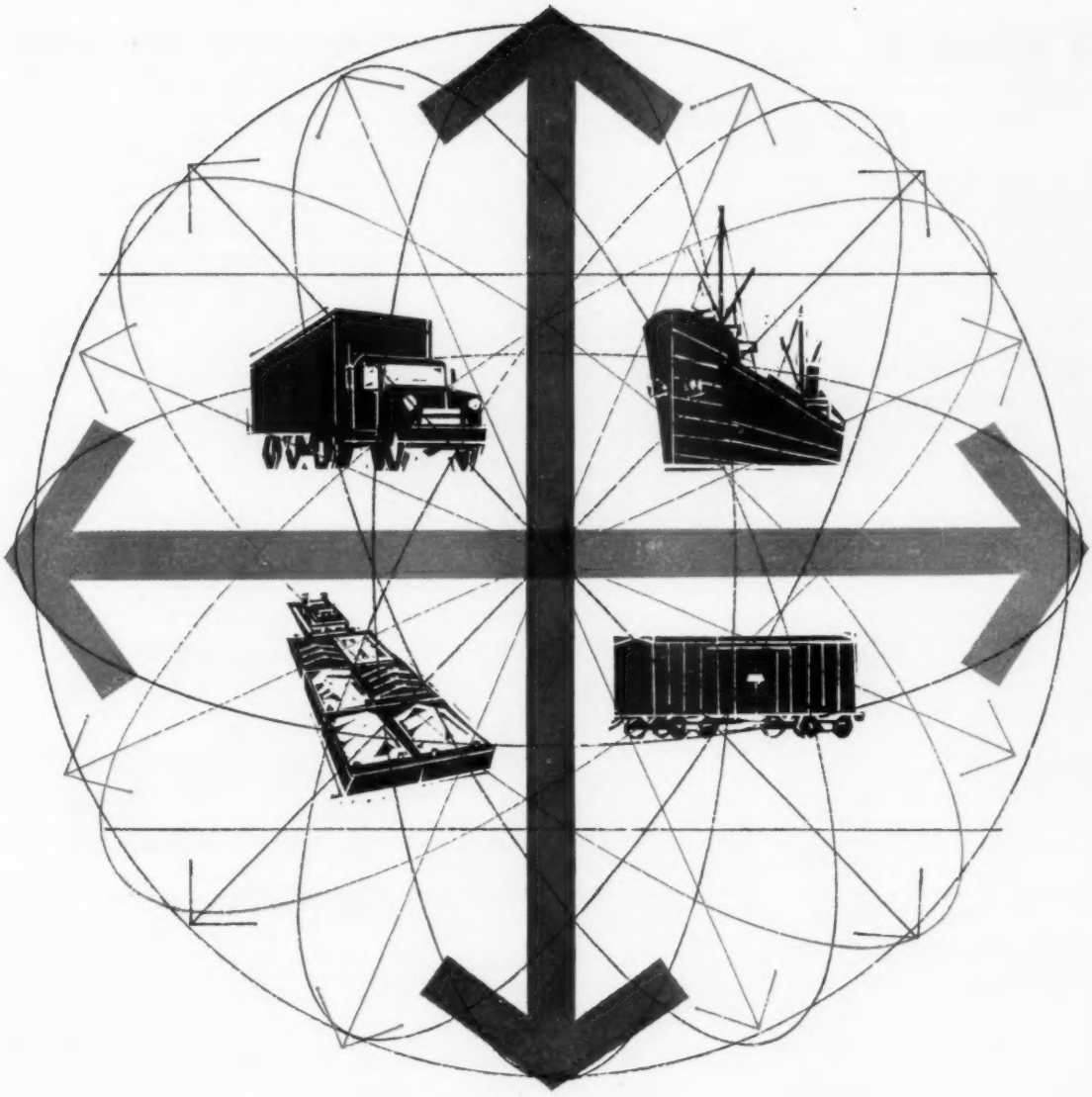
The CPU, a pre-engineered central station air conditioning system, is completely self-contained, housing an evaporator, compressor, evaporative condenser, fans, motors, refrigerant piping, and controls in a grey enamel casing. All components are enclosed. A summer-winter conditioner, the CPU unit also functions as an evaporative condenser water saver. It is available in five sizes from 10 to 40 tons. Dunham-Bush, Inc.

15—COMPACT A-C MOTOR for synchronous applications

The Syncro-Spede is announced as the first synchronous induction motor built in the same NEMA frame size as a standard motor of equal horsepower. According to manufacturer, the Syncro-Spede accelerates as an induction motor but runs at exact synchronous speed without permanent magnets of d-c excitation involving collector rings and brushes etc. It is claimed the most compact a-c motor available for synchronous uses and to offer high power factor and efficiency. It is suitable for many applications requiring constant speed with varying load, company says, and because of its size, it can provide precise frequency systems in small generator ratings. And since this motor is unaffected by voltage fluctuations, it is suggested for precision timing and metering devices and for recording instruments. Offered in ratings from 1 to 100 hp in any enclosure type, it can be foot-or flange-mounted, and is designed for horizontal or vertical mounting. Bulletin 1900 gives further information. Louis Allis Co.

16—VENT SILENCER prevents transmission of noise

Quiet-Vent was developed to prevent transmission of noise through return air vents without impeding passage of air. The silencing unit features functional construction designed to fit snugly inside normal walls. Its uni-



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Only Morton can offer you the right salt for every industrial use, coast to coast

Morton, the only nation-wide salt company, produces, refines, and delivers nearly 100 different grades of salt for 14,000 industrial uses.

This means that regardless of your size, your needs, or your location, Morton can give you expert, impartial advice on which grade or grades will do the best job for you. This is valuable advice because the right salt for the right job will help you reduce costs, save time and turn out products of uniform high quality.

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Morton backs its salesmen with the services of the finest salt research center in the world. If your Morton salesman personally can't solve a salt problem for you, he can refer the problem to Morton's research laboratory for quick, thorough analysis. This service help may be worth thousands of dollars to you every year.

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MORTON SALT COMPANY

INDUSTRIAL DIVISION

Dept. PE-1-58, 120 So. LaSalle Street
Chicago 3, Illinois

For more facts circle 584 on Reply Card

NEW PRODUCTS

(Begins on page 168)

fied one-piece design simplifies handling and installation. Constructed of 22 and 24 gage steel, Quiet-Vent silencers feature an attenuation of 40 decibels or more. Silencers are also being made available in a "hang-on" type for economical installation. Industrial Acoustics Co., Inc.

17—HEAVY DUTY PUMPS feature standardized parts

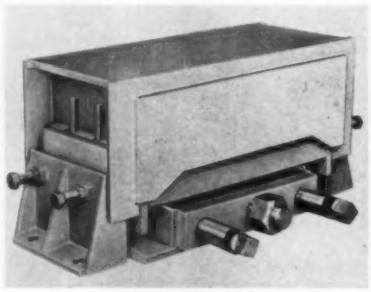
These heavy-duty vertical centrifugal pumps for sump and process service (Figs. 3171-2-3-4), available in single and duplex units, both wet and dry type, have capacities to 1080 gpm with heads to 290 ft for pit depths to 20 ft. Their basic design provides users with custom built pumps through usage of standardized parts. The pumping unit may be adapted in the field for changed pit depths or pump ratings simply by installing new and standardized parts. Vapor proof construction can be supplied on all units. In addition, special construction and materials permit these units to handle various types of liquids. Pump assembly, including cover plate, is a complete unit. Liquid level controls can be furnished to start and stop the pump automatically. Goulds Pumps, Inc.

18—MAINTENANCE KITS for thread repair jobs

With Shop-Pack Kits, stripped threads in machine tools, material handling equipment, electrical equipment etc., can be repaired quickly and permanently on the spot, it is announced. Available in 29 sizes, the kits contain a quantity of inserts, tap and inserting tool in a metal-edged box. Sizes from 6-32 to 1-1½-6 in the N.C. series and 6-40 to ½-20 in the N.F. series. Box and tools are designed for long service simply by replacing inserts as they are used. Heli-Coil Corp.

19—MACHINE MOUNTS simplify heavy equipment installation

Type SW Mountings are reported to simplify installations of the heaviest equipment, reduce installation time, frequently eliminate special chassis or foundation, and increase machine life. The Type SW is described as a vibration, shock and noise isolator utilizing steel springs as the isolation medium; it is available in seven load-carrying capacities from 38,000 to 125,000 lb each. Lengths range from 20 to 35 in.; widths, from 12 to 20 in.



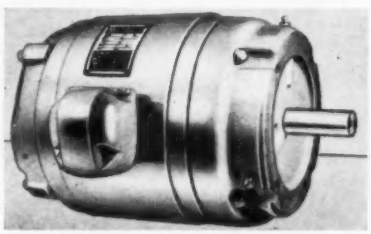
For use with heavy, bulky machinery, the unit is claimed unique in that it is adjusted and leveled from the side, rather than by means of a bolt protruding from the top. Its flat top permits placing the unit in any position under a machine base to provide maximum support of the base, company points out, regardless of availability, location or size of foundation bolt holes. In many cases, it eliminates the problem of drilling holes in bases, it is noted, and shims are not needed. A feature of the Type SW is the internal device which facilitates leveling the machine installation with less torque than required by many leveling systems—of particular value, since these mounts are used to "float" machines weighing up to 1,000,000 lb. The Korfund Co., Inc.

20—STORAGE RACK has molded plastic wheels

In this new model of the Versarack, a live storage rack, the wheels are molded of a high impact plastic, interchangeable with the zinc plated ball bearing steel wheels furnished on the standard Versaracks. Wheel diameter and width of tread are large, for minimum indentation of soft packages, and wheels are free turning and require no lubrication, it is pointed out. Wheels turn on steel axles set in a formed steel rail, and the rails have built-in dividers to separate rows of packages in the rack. The M-H Standard Corp.

21—STEAM TRAP features increased accessibility

Improved, simplified construction increases accessibility of Type FT Float-Thermostatic Steam Trap, it is announced. The entire operating element is one unit, which can be removed without disturbing inlet and outlet connection to semi-steel trap body, suitable for 125 psi steam pressure. Operating elements consist of stainless steel valve mechanism, copper float, and bronze thermostatic air vent. Valve is designed to provide condensate seal and prevent loss of steam. It discharges at steam temperature continuously and without shock, company says. Separate air vent, requiring no adjustment when pressure changes, removes all air and incondensable gases, allowing no steam to escape. Manufacturer recommends the trap to drip steam mains, unit heaters, blast coils, heat exchangers, and other process applications requiring accurate temperature control. Bulletin 455-B gives complete details. Sarco Co., Inc.

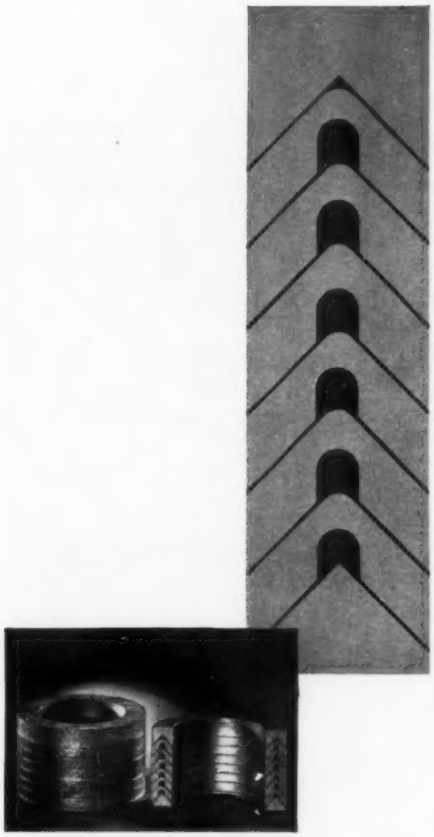


22—FOOTLESS MOTOR offers more hp in less space

Designed for direct connection to driven equipment, this footless motor is supplied with a NEMA style C Unimount bracket for automatic alignment. Available in ratings from 1 to 30 hp, motor is built to latest NEMA specifications, making it extremely compact — more horsepower in less space. Among its advanced features are a Ventrifoil deflector which directs air and deflects water; cast iron one-piece frame; dripproof construction; asbestos-protected windings; cast-iron, split-type conduit box for easy access to motor leads. Rotors are solid cast and dynamically balanced. U. S. Electrical Motors, Inc.

23—VALVE STEM PACKING for medium temperature uses

Style 5022 is a molded type valve stem packing ring made from copper wire inserted asbestos yarns which are braided and impregnated with Teflon suspensoid and die formed into rings. Heart of the Style 5022 is the Teflon which gives the packing unusual characteristics and versatility. According to manufacturer, Style 5022 has mechanical strength and extreme toughness: heat resistance, permitting sery-



Garlock CHEVRON Packing
Set and cross section

CHEVRON®

is a registered trademark of The Garlock Packing Company. It is our responsibility as the manufacturer to see that this trademark is properly used at all times to identify our hinge-type packings. We, therefore, ask that it be used only to designate our product. It should never be used merely as a descriptive or generic term for V-type packings.

CHEVRON Packings are carefully manufactured in Garlock's own factories by experienced craftsmen. Therefore, whenever you see this familiar trademark you can be sure that the packings described will give you long dependable service because they are properly designed and manufactured to the highest quality standards.

Other familiar registered trademarks belonging to Garlock include: BITAN Leather Packings, GUARDIAN Gaskets, KLOZURE Oil Seals, LATTICE BRAID Packings and MECHANIPAK Mechanical Seals. All of these products are sold to you under the Garlock Warranty . . . your assurance that they will satisfactorily perform the service for which they are designed.

THE GARLOCK PACKING COMPANY, Palmyra, N.Y.
For prompt service, contact one of our 30 sales offices and warehouses throughout the U.S. and Canada.

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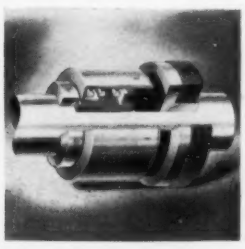
Packings, Gaskets, Oil Seals, Mechanical Seals, Molded and Extruded Rubber, Plastic Products

Garlock BITAN Leather
Cups, Packings and Gaskets



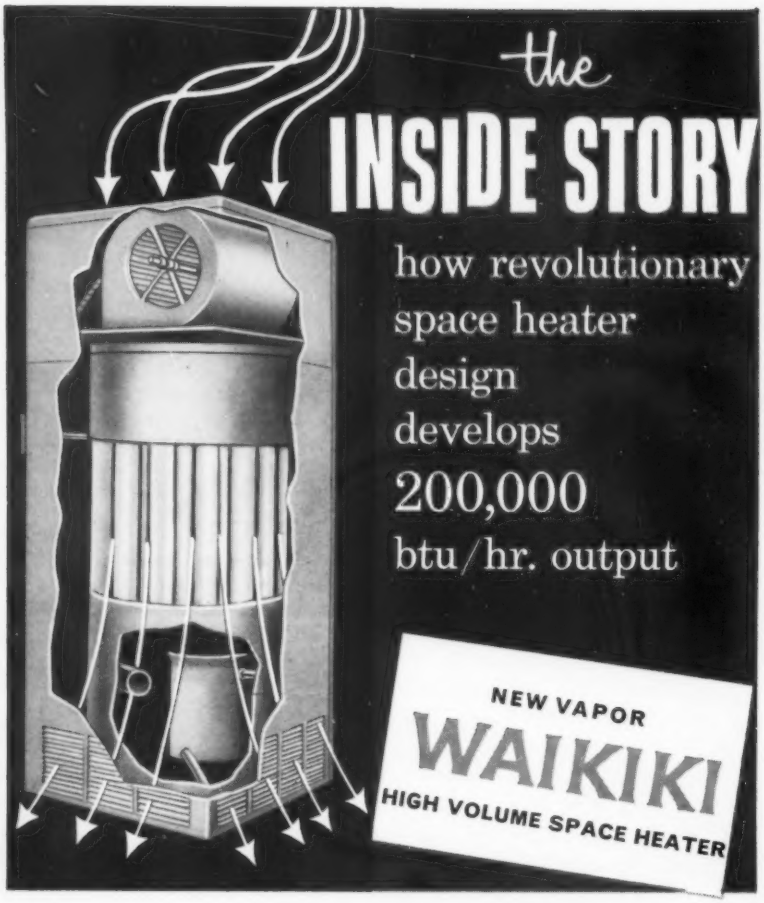
Garlock MECHANIPAK
Mechanical Seal

Garlock GUARDIAN
Spiral-Wound Gasket

Garlock KLOZURE Oil
and Grease Seals for Bearings

Garlock LATTICE-BRAID
Rod and Shaft Packings

For more facts circle 585 on Reply Card



Imagine—this compact 6½ ft. high, 30 in. square space heater produces enough heat to comfortize three 5-room homes! Extra-large heat transfer area (1 sq. ft. for each 3500 b.t.u. of rated output) and high volume *counterflow* air circulation does it. The result: abundant, uniform floor-to-ceiling, thermostatically controlled heat for "spot" or overall distribution—*when* and *where* you want it—with impressive fuel savings.

Installs vertically or horizontally on floor, shelf or balcony—for direct or duct distribution.

VOLUME HEAT WITH TOP ECONOMY

. . . for physical comfort in shops, warehouses, garages; for curing and drying; for thawing and defrosting; for pre-heating.

Burns Kerosene, Fuel Oils Nos. 1 and 2, Gas (Natural, Manufactured, L-P).

Send for Full Facts Today

VAPOR HEATING CORPORATION
80 East Jackson Blvd., Chicago 4, Illinois, Dept. 18-A

Please send New Waikiki Bulletin No. 445A.

Individual_____
Title_____
Company_____
Street_____
City, Zone, State_____

For more facts circle 586 on Reply Card

NEW PRODUCTS

(Begins on page 168)

ice at temperatures to 500 F and low flow under high pressure; a high degree of chemical inertness. It is pointed out that the Teflon acts as a lubricant, eliminating graphite or liquid lubricants, and that the packing is non-contaminating and will not debase or discolor the product handled. The Garlock Packing Co.

More information on any of these products can be yours without cost or obligation. Just circle the item numbers on the Reader Service Cards provided on pages 213-214.

24—DRUM VACUUM picks up wet or dry materials

For big volume pick-up of either wet or dry materials, this power head adaptor unit converts any 30- or 55-gal drum to a high-powered suction machine for pick-up of oils, dust, grain,

water, metal or wood chips, shavings, etc. Unit is equipped with a 1-hp moisture-proof, dust-proof motor, and a three-stage fan to provide maximum suction. The sealed vacuum system develops a 78-in. water lift. Hoses and fittings are available with a 1½ or 2-in. orifice—the 2 in. size for pick-up of larger objects. An automatic shut-off is provided to prevent accidental overflow of liquids; suction stops when drum is filled. Machine is also equipped with a blower for blowing dust and chips out of motors, lathes, etc. Power head can be lifted off and transferred from one drum to another. Advance Floor Machine Co.

25—TRANSMISSION BELT with stretch resistance

Belt stretch is claimed to be minimized in the Unicord. It is designed for use on all type drives and its length uniformity is said to be maintained by controlling the amount of moisture in the air during manufacture. As man-

BENJAMIN

...always the source of good lighting... anywhere in the plant!

Now Setting the Pace in COMMERCIAL LIGHTING too!

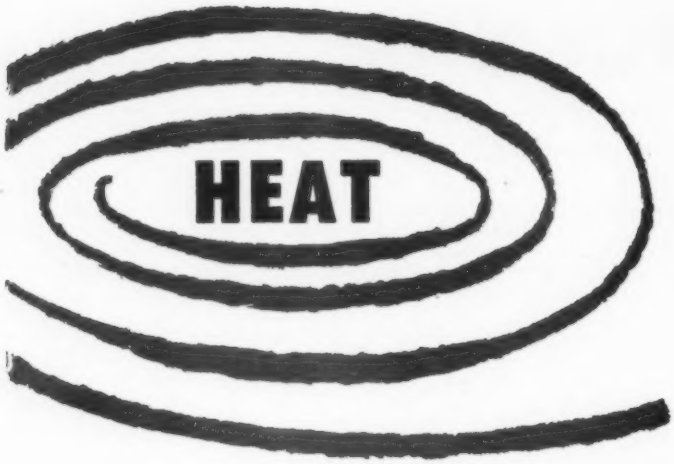
If you could look at your factory with the roof off like this — you'd get an idea of the many different lighting units it takes to provide the right light for every seeing task. When you specify BENJAMIN you are assured of a specially-engineered unit for every factory and office location—designed for better seeing with maximum eye comfort.

Send for illustrated data bulletins on any or all of the units shown here. Benjamin Electric Mfg. Co., Dept. PE, Des Plaines, Illinois

1. Explosion-Proof Units
2. Vapor-Tight Incandescent
3. Triple-Flo Continuous Lines
4. Stream-Flo Continuous Systems
5. Stream-Flo w/27° Shielding
6. RLM Dome Reflectors
7. Stream-Flo w/Plastic Covers
8. Elliptical Angle Reflectors
9. Steelite Armor-Clad Units
10. Twin-Flo Individual Units
11. Symmetrical Angle Units
12. Semi-Direct Industrial w/25% Uplight
13. Twin-Flo w/10% Uplight
14. Panel-Glo Safari Systems
15. Stock-Bin-Lite
16. Officer Louvered Units
17. Panel-Glo Corrugated Systems
18. Glass-Enclosed Troffers
19. RD Projectors
20. Duo-Service Floodlights

R133RR

For more facts circle 586 on Reply Card



. . . may be the "trouble" with your electrical system

Are you troubled with nuisance power interruptions, insufficient branch circuit capacity, motor burnouts and the accompanying costly production delays? You will probably find that *heat* affecting your protective electrical equipment is the heart of your trouble.

You can eliminate heat considerations, however, simply by replacing with HEINEMANN Circuit Breakers.

HEINEMANN Circuit Breakers do not employ thermal elements or heaters of any type. Thus, their current carrying capacity and all set tripping points are completely independent of ambient temperature . . . unaffected even by nearby furnaces, steam pipes or cold drafts. HEINEMANN Circuit Breakers do not require de-rating. With HEINEMANN, 20 amperes means 20 amperes of usable capacity without needless tripping.

HEINEMANN Circuit Breakers operate on a hydraulic-magnetic principle. They provide inverse time delay to allow starting inrush or harmless, temporary overloads . . . yet they provide the fastest circuit interruption available on large overloads or short circuits.

GET THE COMPLETE FACTS: Send for your copy of "WHAT YOU SHOULD KNOW ABOUT CIRCUIT BREAKERS". Ask for Manual 101.

HEINEMANN ELECTRIC COMPANY
128 Plum Street • Trenton 2, New Jersey

HEINEMANN Circuit breakers

For more facts circle 588 on Reply Card

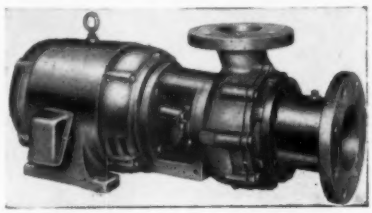
NEW PRODUCTS

(Begins on page 168)

ufacturer explains, too much moisture in the air can cause cords to shrink; then when the belt is in operation the heat generated dries the moisture and the belt lengthens. In addition to being made in a humidity controlled room, the Unicord is packaged in a hermetically-sealed polyethylene bag. The Unicord is so named because the tension member consists of one ply of super strength synthetic cord, reportedly as strong as five plies of company's No. 50 cord. Flex life is thus said to be greater than other constructions on small pulleys because there are no plies to separate. A loop built belt, the Unicord has folded edge construction. Pulleys as small as 4 in. are recommended by manufacturer. This belt comes in widths from 4 to 6 in., lengths from 100 in. to 45 ft. B. F. Goodrich Industrial Products Co.

26—END SUCTION PUMP for general service

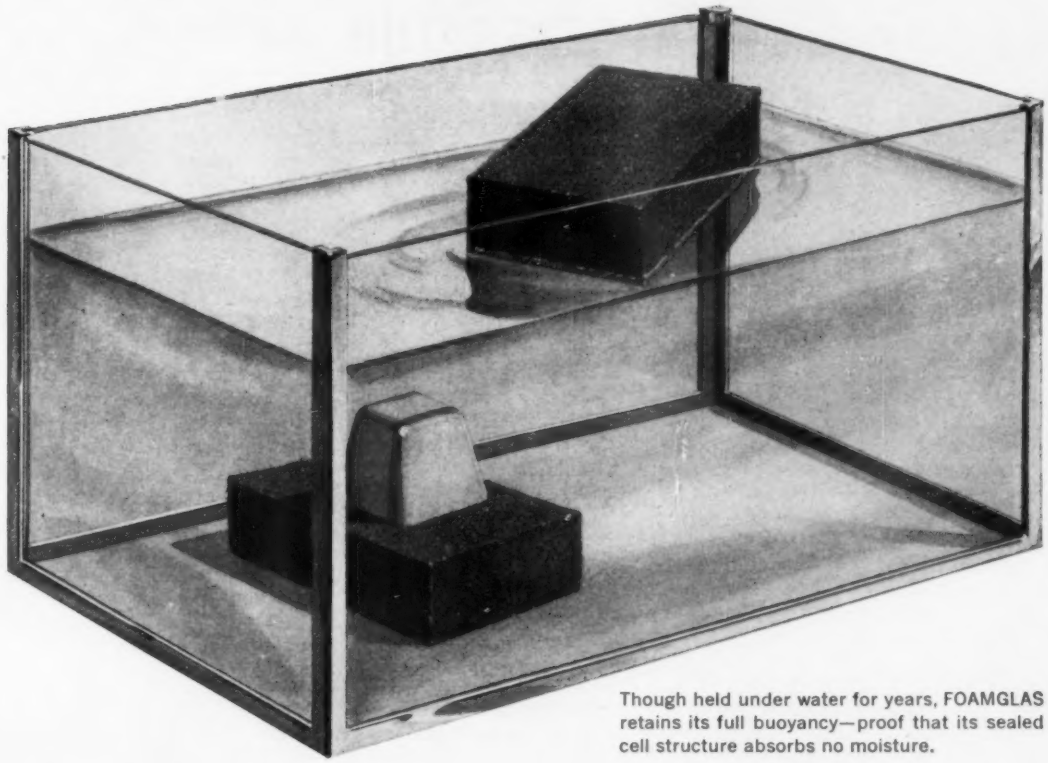
Type BC Pumps are general purpose units in close-coupled horizontal, flange mounted vertical, base mounted vertical, and pedestal mounted horizontal models. Sizes range from ¼ to 40 hp at 3500 rpm, ¼ to 20 hp at 1750 rpm. Suggested uses for the



pumps include circulating, coolant, cooling towers, condensate return, filters, others. According to manufacturer, these pumps possess low NPSH characteristics to meet critical suction conditions. The pumps may be changed from packing to seals by means of interchangeable inserts: mechanical seal, packing, water-cooled stuffing box with mechanical seal, and water-cooled packing box. Details are in Bulletin 119-C. Aurora Pump Div., The New York Air Brake Co.

27—CONTROL UNIT aids in machine welding

This unit is designed to provide programmed control of all functions of machine Heliwelding—this company's inert-gas-shielded metal-arc welding process using a nonconsumable tungsten electrode. The unit consists of a main panel containing the adjustable



Though held under water for years, FOAMGLAS retains its full buoyancy—proof that its sealed cell structure absorbs no moisture.

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INSULATION

is waterproof

... not just water-resistant!

FOAMGLAS insulation stays dry before, during and after application—maintains its original insulating value on the roof, walls, piping or equipment it protects. Since FOAMGLAS is completely inorganic, it can't burn, is acid-proof and dimensionally stable. Write for latest literature.

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In Canada: 57 Bloor Street West, Toronto, Ontario

For more facts circle 589 on Reply Card

How a Clayton STEAM GENERATOR SOLVED THREE different STEAM PROBLEMS!

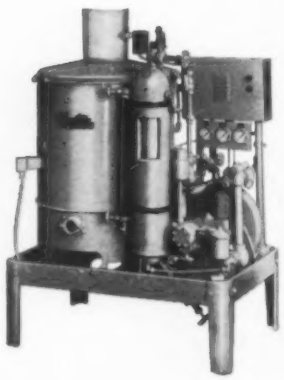
"WE WERE FACED WITH AN OBSOLETE CENTRAL BOILER ROOM AND DETERIORATING TRANSMISSION LINES"

This well known chemical company had a sprawling plant with long transmission lines and condensation problems. Fluctuating steam needs throughout the plant made steam production a problem. The ordinary boiler had to be kept at full pressure all day . . . fired all night. Seven Clayton Generators strategically located now provide just the right amount of steam—when and where needed. They are shut down at night. These seven Clayton generators installed cost less than the cost of new transmission lines.

"OUR STEAM NEEDS FLUCTUATED CONTINUOUSLY. WE DIDN'T NEED COSTLY FULL TIME STEAM!"

This small metal working plant had a boiler that required a 24-hour fire and a man to watch it. Steam requirements fluctuated considerably wasting both fuel and steam. A Clayton replaced this obsolete boiler to produce only the right amount of steam when needed . . . automatically. Since it's fired only for the shift, fuel savings are considerable and a full time man is not required.

These actual case histories represent only a few of the reasons why smart business men buy Clayton Steam Generators. Basically the story is more steam at less cost in only one fourth the space occupied by ordinary steam boilers. They cost less to install too . . . no stacks to erect, no walls to knock out, lower rigging expense and lower hauling costs. The secret of Clayton's higher efficiency is *controlled circulation*—no space consuming straight tubes, but instead, a principle of using a coil without fired vessels . . . easier to operate and maintain. From a cold start, Claytons produce steam in 3 minutes. Let a Clayton representative give you the complete facts.



"IT WAS HOPELESS! WE NEEDED MORE STEAM AND WE DIDN'T HAVE ROOM FOR IT!"

Here was a well known beverage syrup company located in "midtown" squeezed in between buildings on all sides. To meet its additional steam needs, it went in only one direction . . . up! Since a Clayton produces the same amount of steam in only one fourth the space and weighs only a fraction as much as an ordinary boiler, it was relatively simple to put two Clayton steam generators on the roof! The installation was quick and inexpensive.

EXCLUSIVE!

Compare Clayton's 5-year published coil warranty covering material and labor.

Clayton MANUFACTURING COMPANY

Sirs:
Please send us more information on Clayton Steam Generators.

Name _____

Company _____

Address _____

City _____ Zone ____ State _____

We use steam for _____

Send to: Clayton Manufacturing Company
401 N. Temple City Blvd.
El Monte, California

For more facts circle 590 on Reply Card

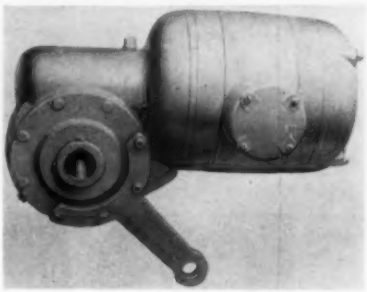
NEW PRODUCTS

(Begins on page 168)

control mechanisms, and a push-button remote control station. The system is for use with high-frequency current and d-c straight-polarity welding power from a saturable-reactor-controlled rectifier-type supply. For applications requiring precise weld timing and crater filling on repetitive circumferential or longitudinal welds, it simplifies Heliwelding of production items. Control timing mechanisms are set in advance. Air Reduction Sales Co., Air Reduction Co., Inc.

28—GEAR MOTORS, shaft mounted, right angle type

This line of shaft mounted right angle gear motors includes sizes from ¼ to 5 hp. The shaft mounted design offers simplicity and efficiency of installation,



it is noted, because it eliminates intermediate transmission elements. Coupled with the weight saving characteristics of aluminum construction, these right-angle gear motors are designed to provide a compact installation especially suitable for lighter pieces of machinery or use in small areas. The smooth surface can be easily cleaned, company notes, making the unit ideal for chemical and food applications. Sterling Electric Motors, Inc.

29—TUBE CLEANER designed to work quietly

Rotojet Electric Tube Cleaner has been developed for tubular equipment in plants where the noise of conventional air-driven tube cleaners is objectionable, or where compressed air or water at high pressure is unavailable. It cleans scale, mud, carbon and other deposits from straight tubes 25/32 in. ID through 4 in. ID in water tube and fire tube boilers, condensers, evaporators and heat exchangers. The unit consists of a stand-mounted motor, flexible shafting, electric cable, and a selection of cutter heads, brushes, drills, and scrapers to meet specific cleaning requirements. The motor is mounted in a yoke to permit vertical

For more facts circle 591 on Reply Card →

FOOT SWITCHES that can take it!

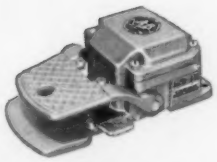
• **BUILT FOR THE TOUGHEST SERVICE** inside and out—from the maintenance free, snap action, double break, silver alloy contacts to the rugged, die cast aluminum housing—the redesigned Allen-Bradley Bulletin 805 foot switch is a challenge to tough jobs! The on-center treadle operation eliminates the need for bolting down the switch—the extended base keeps it from tipping.

• **VERSATILE OPERATION**—The contact trip point is easily adjustable. When equipped with two contact blocks, this foot switch can be set for simultaneous or two-stage operation. The Bulletin 805 foot switch can also be furnished with a latch to provide maintained contact operation. In addition, this latch, when desired, can be made inoperative, and may be quickly changed from one to the other side of the foot switch.

The Bulletin 805 housings are available for NEMA Type 4 watertight and oiltight applications, or NEMA Type 7 explosion-proof service.

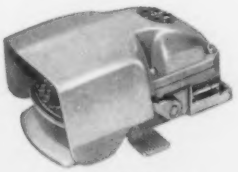
Try the Allen-Bradley Bulletin 805 foot switch—you'll find it "tops" in its field. Send for full information.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.



Bulletin 805 Style A switch with latch.

Bulletin 805 Style A switch with latch and top guard to prevent accidental operation.



Bulletin 805 Style A switch with latch and guard covering both top and sides.

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

1-58-MR

Husky

BULLETIN 801

LIMIT SWITCHES

IN A THOUSAND AND ONE TYPES

A-B
QUALITY
Roller lever type in watertight enclosure.
Cutaway view of Bulletin 801 heavy duty limit switch. Note the sturdy construction.
Roller fork type in watertight enclosure.
Lever type for rod or chain operation.
Push type, heavy duty switch.
Center roller, standard duty switch.
Switch with two independently adjustable rollers.
Fork type, snap action switch.

From among the hundreds of Allen-Bradley Bulletin 801 general purpose limit switches, you're sure to find your exact requirements. There are 21 different contact arrangements available, including types with single or multiple poles, N.O. and N.C. contacts, spring return or maintained contacts, with either a slow or snap action mechanism. It will pay you to know this *quality* line of limit switches. If you do not already know this quality line, let's get acquainted. Write for the complete story.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

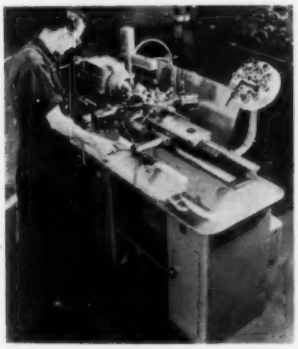
1-58-MR

(Begins on page 168)

and horizontal movement so that tubes can be cleaned without moving stand. Elliott Co., Div., Carrier Corp.

30—SCREW MACHINE for the short run work

Announced as the first of its kind in its price range, this versatile hand screw machine is designed primarily to cut costs at plants frequently faced with short production runs—50 or 500 or 1000 pieces, for example. Manufacturer says it combines time- and cost-saving features of rapid chucking



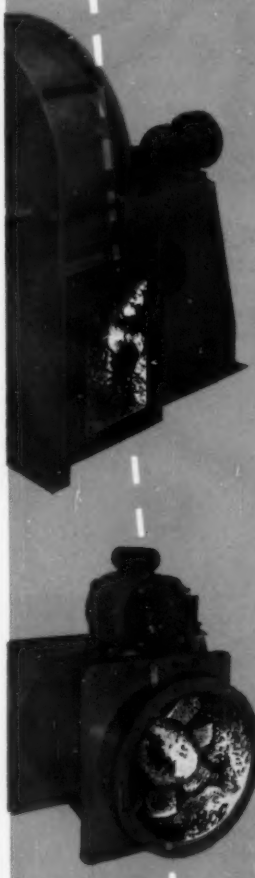
and multiple tooling with advantages of low initial investment, lower maintenance costs and power consumption, minimum setup and changeover time and small space requirements. It is suggested for repetitive manufacturing of a variety of parts—from the simple to the intricate—or any operation involving production of a limited number of precision parts. Through use of tooling, this hand screw machine, is claimed to machine as many as 50 parts in the time it would take to produce one on an engine lathe. It features a bed turret with six stations for up to six operations. The turret is moved from one operation to the next with a simple turn of the pilot wheel—and the work piece is chucked by a touch on a lever. Delta Power Tool Div., Rockwell Mfg. Co.

31—INERTIA SWITCH protects unattended equipment

Originally designed for aircraft and missile uses, this inertia switch is reported to provide full-time low-cost protection for unattended industrial equipment. The switch is described as an automatic device actuated by thrusts, impacts or excessive vibrations. For example, if unusual vibrations occur, the switch (the 1SA1) senses the trouble, shuts off the machine or sounds an alarm. In this

are these the
"TROUBLE SPOTS"
IN YOUR EXHAUST SYSTEM?

SOLVE YOUR CORROSION PROBLEMS
with
INDUSTRIAL PLASTIC FABRICATORS'
P. V. C. Blowers and Fans



If your company is engaged in pickling, plating, anodizing, etching, bleaching and chemical processing operations, IPF PVC centrifugal blowers and tube-axial fans can stop corrosion in your exhaust system.

Have you ever figured the corrosion losses of your present exhaust system? With conventional type blowers and fans, you don't buy corrosion but you never stop paying for it in repeated paintings and protective coatings, replacement costs, lost production time and interruption of critical processes.

You can prevent such losses with IPF PVC blowers and fans. They outlast conventional types of fans three to five times . . . resist most corrosive fumes and combination of fumes . . . are lightweight, smooth, non-porous, plastic and never require repainting or recoating.

Descriptive literature on the complete line of IPF PVC fans, tanks, hoods, ducts and stacks is available on request.

ipf

MANUFACTURED BY
industrial plastic fabricators, inc.
NORWOOD, MASS. NOrwood 7-3411

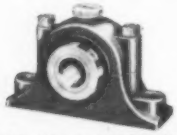
REPRESENTATIVES THROUGHOUT THE UNITED STATES

For more facts circle 592 on Reply Card

DODGE PRODUCTS you should know

FLEXIDYNE
THE DRY FLUID DRIVE
100% efficiency at full load!

TORQUE-ARM
SPEED REDUCERS
Cost less—deliver more!



DODGE-TIMKEN
America's Quality Pillow Blocks!

●

DODGE BULLETINS YOU SHOULD HAVE—

- Flexidyne Dry Fluid Drives and Couplings. Bulletin A-640-A.
- Torque-Arm Speed Reducers. 15 sizes—1 to 100 hp. Bulletin A-637
- Roller Bearings. Load ratings, dimensions, etc. Bulletin A-638.

Write for your copies.
DODGE MANUFACTURING CORPORATION
2700 Union Street • Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

For more facts circle 593 on Reply Card

NEW PRODUCTS

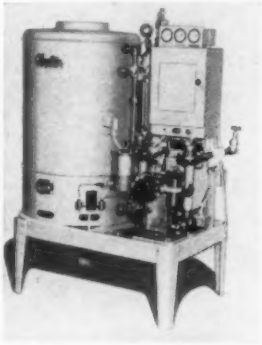
(Begins on page 168)

way, isolated fans, compressors and machinery may be continuously protected. It is explained that once actuated, the switch remains operated and cannot be jarred back into an unoperated position. A manual reset button is provided to reset the switch, or an electrical reset may be had.

The switch operates when subjected to a thrust in any horizontal direction. A vibration or thrust under the minimum duration of 1/30 sec will not actuate the switch. Force-of actuation settings may be supplied from 1.5 to 10 or more G's. Contact arrangement of the 1SA1 is a single pole normally closed. Micro Switch, Div., Minneapolis-Honeywell Regulator Co.

32—STEAM GENERATOR has increased horsepower

Formerly offering a normal rated boiler horsepower of 15, these forced-circulation generators with "balanced-feed" design are now also available



with a 30-hp rating. Maximum horsepower has also doubled, from 16.5 to 33 hp. Normal Btu output at 33,475 Btu per hp therefore becomes 1,004,250 in normal operation. Normal steam output is 1,035 lb per hr. The steam generators are designed with a pressure of 200 psi. The Clayton Mfg. Co.

33—SAFETY SPEC to give to your plant visitors

This low cost spectacle, the Ipco Visitor's Spec, is intended to be given to plant visitors to wear while on tour and to take home with them. Attractively modern in appearance, the frame is molded of cellulose acetate in demi-amber color and the lenses are curved, clear plastic, 0.052 in. thick for impact resistance. Manufacturer says the one size fits all faces, with or without personal glasses. Each spectacle is furnished in a sealed cellophane envelope. Industrial Products Co.

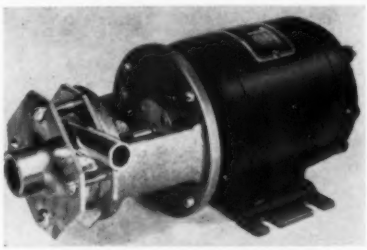
Reader Service Cards on pages 213-214 make it easy to get further information on any of these products. Just circle the item numbers of the products you would like to know more about.

34—VALVE OPERATOR is explosion-proof unit

The SM-11-X Valvetrol is announced as an explosion-proof electric valve operation which mounts directly on the stem of rotary valves and provides proportional flow control from a-c or, d-c signal. It may provide remote control from a pushbutton station with meter indication of valve position, or it may provide proportional control in automatic systems with the control signal originating from a d-c, zero to 5 milliamp source, or from an a-c control signal. A built-in potentiometer or differential transformer serves to provide positioning accuracies of ± 1/5 of 1 per cent of full scale for standard models. Conversion from manual to remote or automatic operation is obtained for most valves by removing the handwheel and installing the Valvetrol. The Jordan Co., Inc.

35—CENTRIFUGAL PUMP is compact, efficient

Compact design and performance features of the Model 10 Pump make it adaptable where space and portability are factors, it is announced. The unit is powered with a 1/7-hp high-speed, fan-cooled motor, suitable for intermittent or continuous duty. Pump and motor are close coupled and made of Type 316 stainless steel, with a packing seal of the Teflon-impregnable as-



bestos type. The pump may be mounted in any position and the outlet may be rotated 360 deg. Overall size of pump and motor is 8-by-4-by 3⅝ in. and weight is 5¾ lb. complete. According to company, the pump is rated at 80 per cent efficiency, has a capacity of 12 gpm for water or thin slurries, and generates 55-lb pressure at shut off.

Volume of fluid discharged can be controlled by a valve in the discharge

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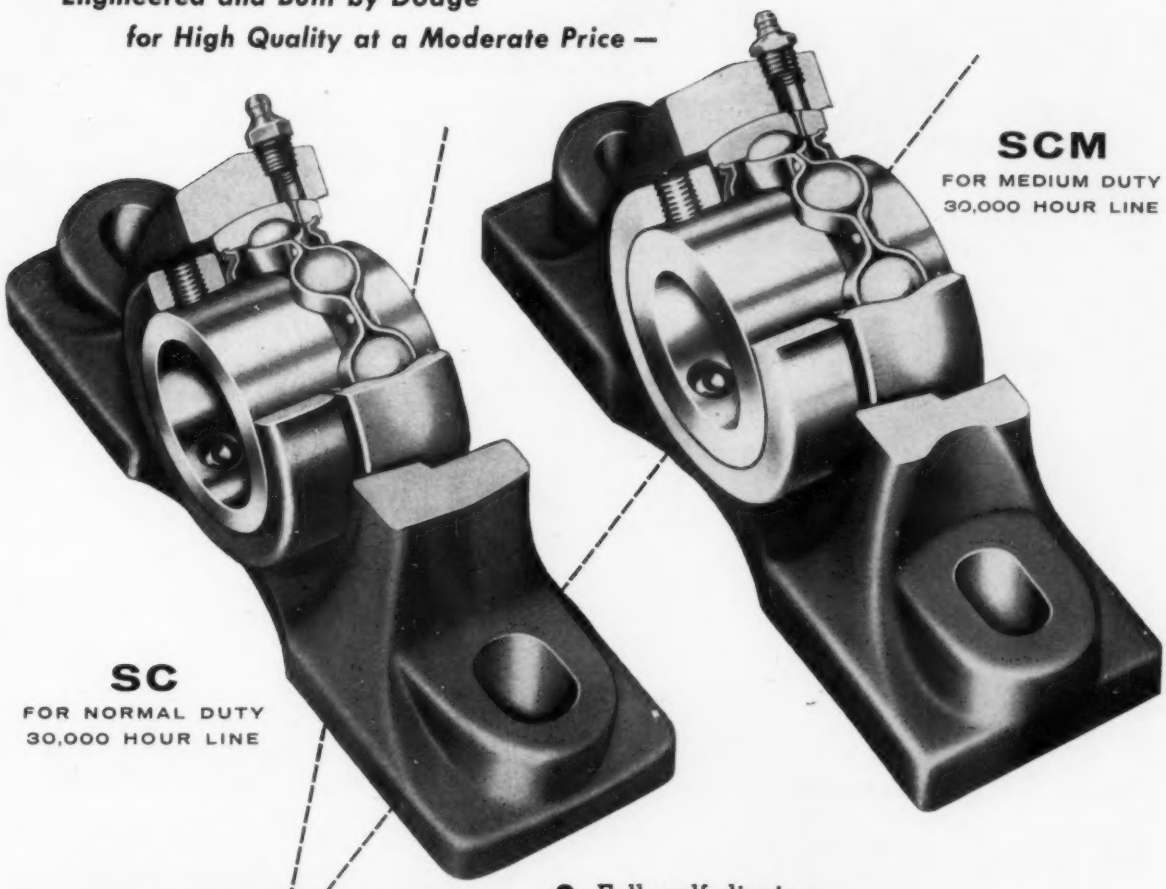

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30,000 HOUR LINE

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30,000 HOUR LINE

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- Metallic backed synthetic rubber seals keep lubricant in, dust and dirt out. Engineered to stay put—*the seal won't blow!*
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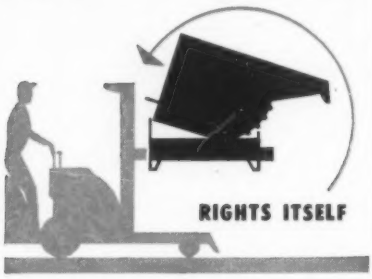
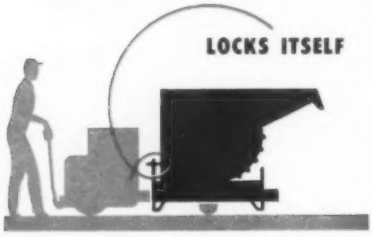
For more facts circle 594 on Reply Card





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1413 Woodland Ave., Detroit 11, Michigan

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NEW PRODUCTS

(Begins on page 168)

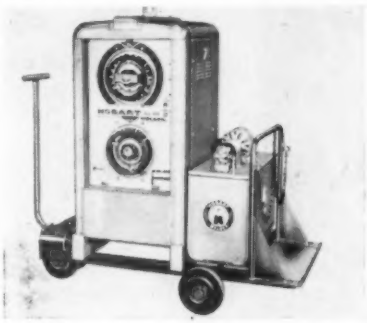
line. If rubber hose is used, a simple clamp will serve, it is noted, and restricting the flow in this way does not overload the motor as these pumps require less power when pumping less fluid. A rheostat is available to adjust flow and pressure simultaneously. The complete unit costs less than $100. Oscar Fisher Co., Inc.

36—COMPACT BREAKER saves on mounting space

This compact 100-amp molded case circuit breaker, the EH frame unit, is for use in panelboards, switchboards, load centers and individual enclosures. For 480-v applications, the new breaker saves mounting space requirements by 40 per cent over the F frame, and is the same physical size as the E frame breaker. Coordinated thermal-magnetic operating characteristics are designed to assure protection against overload and short circuit conditions. Common tripping, quick make-quick break operation and a three-position operating handle are features. The EH frame breakers are available in two and three-pole construction, 10 to 100 amp continuous ampere rating, 480 v a-c, 250 v d-c, an interrupting rating of 10,000 amp. I-T-E Circuit Breaker Co.

37—INERT GAS WELDER has its own water supply

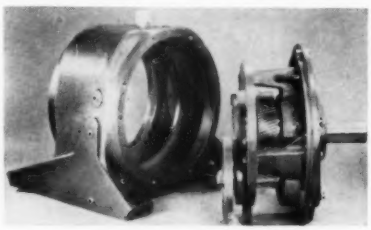
For large operations where inert gas shielded arc welding equipment is needed at different stations, company introduces an a-c d-c inert gas shielded arc welder combination together with Circoolator (water tank with motor-driven pump). This combination, which also provides the rack for inert-



gas-cylinders on which the torch, hose and cables may be draped, is said to save time by letting operator change inert gas welding stations without installing water lines or changing hose connections. The Circoolator provides an independent water supply for cooling inert gas welding torch. It is a 20-gal terne plate tank, rust proofed and baffled. On removable top plate is an all-bronze, rotary gear pump with piston finished shafts of stainless steel, flexibly coupled to a ⅓-hp motor for operation on single phase, 60 cycles, 110 v. Carryall unit is available with solid rubber tires or disc steel wheels. Hobart Brothers Co.

38—SPEED REDUCERS are helical gear units

Moduline is the name given to a new line of helical-gear, speed-reducing apparatus. Basic sub-assemblies and accessories are combined to make any helical gear drive configuration, and the use of parts common to a variety of configuration has enabled mass production. Heart of the gear line is a double-reduction cage with a fixed 5-to-1 set of low speed gears. High-



speed change gears are mounted on rolled spline shafts so that they can be mounted or replaced with common hand tools. Gears in the triple and quadruple reduction subassemblies are also spline mounted. Seven unit sizes to 30 hp are available with ratios of 5-to-1 to 625-to-1.

Stock components are the building blocks for the gear motors, separate speed reducers, and package motor (sugar-scoop) reducers. These standard components can be assembled into arrangements providing for floor, ceiling, wall or angle mounting. Addition of accessories provides further versatility. It is stated that by using the same basic parts, a hollow shaft and aluminum cover, shaft mounted reducers with any of the standard American Gear Manufacturers Ass'n ratings can be assembled. Westinghouse Electric Corp.

39—LUBRICATOR SYSTEM for use with air tools

Automatic in operation, the Auto-Fill Lubricator System is designed to eliminate need for hand filling, of importance in plants having many air tools. According to manufacturer, this system provides a sufficient oil supply in all lubricators at all times with little attention. All lubricators are supplied with oil from one source, with no limit

NEW PRODUCTS

(Begins on page 168)

to the number in use, all being fed from same supply line. These lubricators don't interfere with operational air pressure, it is noted, as all units can be operated on different pressures if desired. Wilkerson Corp.

40—CONTROL VALVE for high pressure service

Type 505 is a high pressure control valve specially designed to handle gases and liquids in high pressure drop, on-off or throttling service, with

dead-end shutoff. The split body construction valve has a pressure and temperature rating of 10,000 psi at —40 to 400 F. It is available with a direct or reverse action actuator with standard 3-15 and 6-30 psi instrument air range. Body is forged stainless steel. Connection sizes are ½ and ¾ in. NPT. Connections for high pressure tubing included. A. W. Cash Co.

41—VAPOR CONDENSER uses water economically

Evaporative cooling with rejection outdoors of the heat of condensation is utilized by this new Aero Vapor Condenser. Vapors are condensed in two parallel-mounted, water sprayed coils enclosing a central plenum under the fan section. The air stream enters above the coils, travels downward over them and enters the plenum, where it drops its entrained moisture, and passes up and out through the fan. Spray water is recirculated; only a small amount being consumed (reportedly 1000 Btu per pound of water evaporated, plus a small wastage). Condensate is recovered by draining it into a manifold where a baffle tube screens out non-condensables. The non-condensable gases are sub-cooled by 7 or 8 deg and ejected by a steam ejector or a vacuum pump. Vapor mixed with non-condensables is condensed and returned through tubes.

Condensing temperature may be

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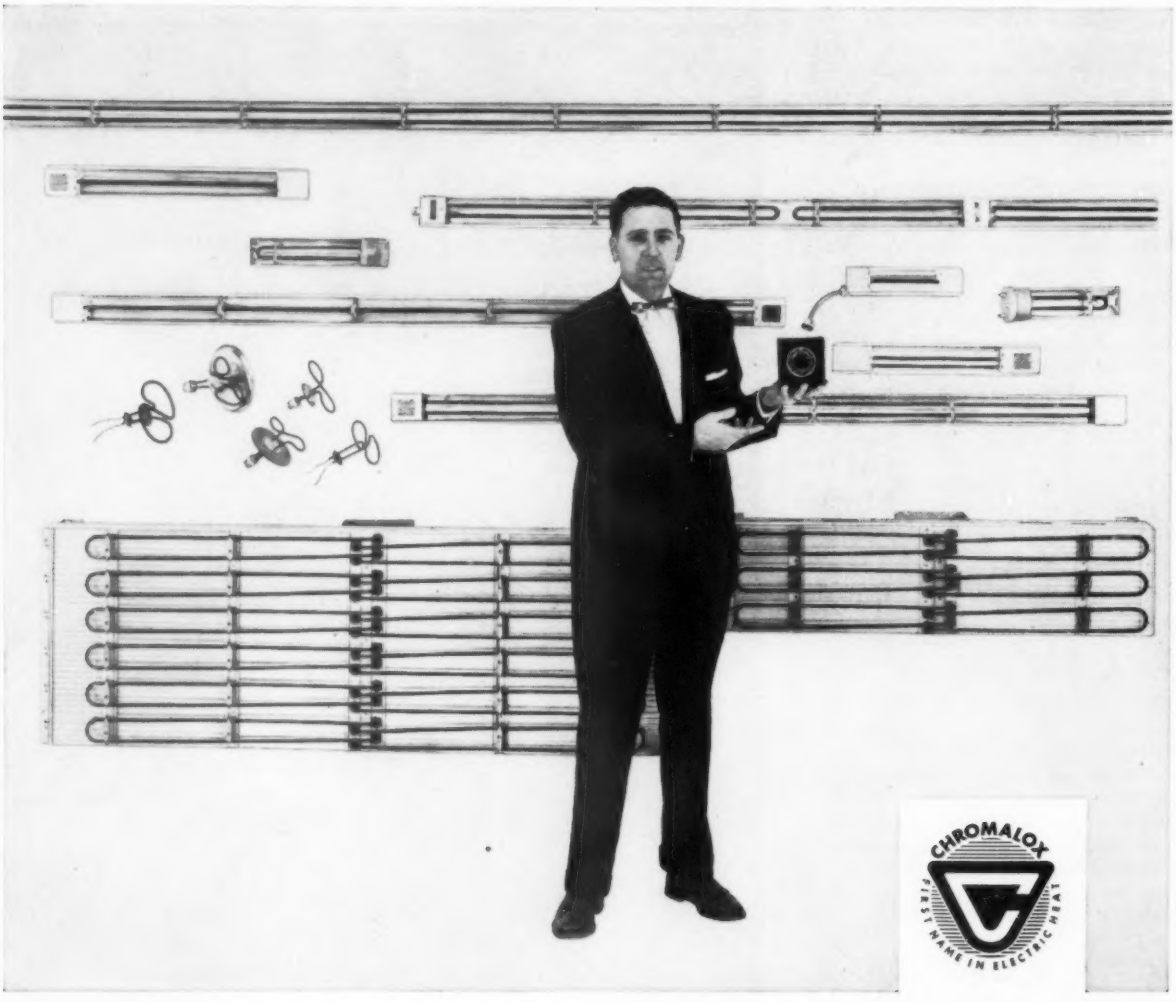
For more facts circle 596 on Reply Card

New heating problem? Old production headache? Rx: Far-Infrared



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At his fingertips, your Chromalox Representative has the answer to production delays, irregular product quality and other common problems caused by complex, outmoded heat sources. Chromalox Electric Far-Infrared radiation can be simply and precisely controlled over largest work areas, and is absorbed uniformly by practically all colors—even optically transparent materials.

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Get the best answers to all your heating problems. For assistance on new installations, or on improving an existing system, call or write your Chromalox Sales Engineering Representative. Standard heaters, to fit most jobs, are ready for immediate shipment from the world's largest stock. What's more, your Chromalox Representative offers factory design-engineering service for special applications. He has the electrical answer that's fast, clean, safe, accurate and economical.

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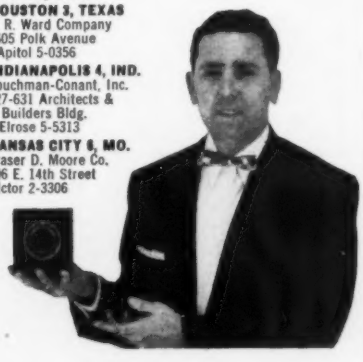


NEW PRODUCTS

(Begins on page 168)

low, within 20 F of the ambient wet-bulb, and a high vacuum is economically maintained, says manufacturer. All sections of the condenser are encased and separately removable panels afford accessibility. Company suggests this condenser as a replacement for barometric type units when needed to conserve water, steam or power, or to provide a higher vacuum to aid processes. Niagara Blower Co.

42—LEVEL GAGE is readable under all conditions

This steam-boiler water-level gage remains readable under all conditions, cannot explode, and can be harnessed to operate controls automatically, it is announced. For use where steam pressures run in excess of 750 psi, the instrument is similar to conventional

gages in size and shape, but instead of glass or quartz tube, it consists of a non-magnetic stainless-steel pipe enclosing a metal float which carries a powerful permanent magnet. As the float rides up and down on water in tube, the magnet acts through tube walls upon row of metal reeds mounted beside it. Painted white, each reed can be pulled forward by magnet so that it comes into view through a window in front of gage. When float moves again, the reed recedes out of sight. In addition to serving as visible indicators of water level, the reeds can carry electrical contacts which operate automatic water controls or set off alarms. Quick-acting valves at top and bottom of gage serve to disconnect it from boiler if leak or other trouble develops. Charles Engelhard, Inc.

43—DEGREASER cleans hundreds of parts in minutes

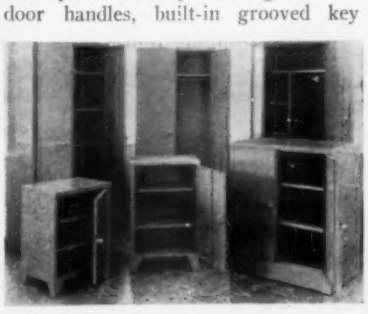
The J. P. Whirlpool Industrial Cleaner is designed to degrease oil, grease, sludge, Cosmoline, while cleaning out metal cuttings, borings, drillings—all in one mechanical operation. Using caustic or detergent as the cleaning agent, unit creates a "whirlpool" action to remove and trap dirt and accumulations. It employs power driven propellers to achieve high speed fluid velocity and centrifugal force agitation which can also be used to strip paint, varnish and gum. Described as ideal for the cleaning of production-line castings, gears, bearings, and other metal parts difficult to clean in many cleaning machines, this cleaner comes in 75- to 2000-gal units. It can be used as an integrated part of a production line or as an individual unit. Each of ten standard models available uses any of the customary methods of heating the washing solution—gas, steam, electricity, oil. Argosy Industries, Inc.

44—BASEBOARD HEATERS available in longer length

Two new lengths of electric baseboard heaters— 4 ft and 6 ft—have been added to the 2-ft lengths previously available. The new sections offer greater flexibility in baseboard heating installations. Their use is claimed to cut installation time, since there are fewer sections, few connections, and faster assembly. Units are installed along wall in place of baseboard. Maximum temperature of vertical outer surface is just above normal body temperature. A control panel is coupled into heating system of each room, allowing room-by-room use and conservation of heat. Only power requirement is a source of 240 v a-c. Units are rated 250 w per foot, and are 7 in. high and 2-⅝ in. wide. Although primarily for surface mounting, units can be recessed. Westinghouse Electric Corp.

45—STEEL CABINETS have improved features

This line of steel cabinets for use in industrial plants and warehouses includes storage cabinets, wardrobe cabinets, combination storage and wardrobe cabinets, desk-height efficiency cabinets, counter-height utility cabinets and tool-room cabinets. Cabinets feature smooth, streamlined exteriors, three-point security latching, chrome door handles, built-in grooved key



NEW PRODUCTS

(Begins on page 168)

locks, cornice tops, no-sag doors, flush hinges and adjustable shelves. Of heavy gage steel, cabinets are finished in oven-baked enamel, sprayed over a corrosion resistant undercoat. Colors are gray and green. Penco Metal Products Div., Alan Wood Steel Co.

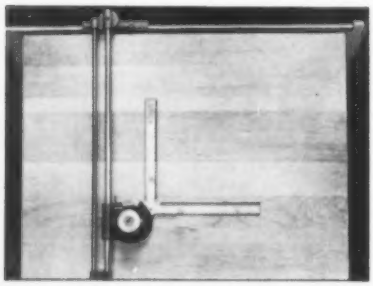
To receive product data circle item numbers on the handy Reader Service Cards provided on pages 213-214.

46—CONVERTER puts shaft rotations into decimals

High speed conversion of shaft rotations into discrete decimal digits for punch or printer systems is the function of this digital converter. According to manufacturer, it effects significant economies in telemetering, data reduction and logging, and inventory control operations. Equipped with printed circuit commutators, the converter operates from any shafted mechanism, such as a self-balancing potentiometer or servosystem used to convert electrical data into shaft positions. It accepts strain gage, thermocouple, photometer or bolometer outputs; voltage, power, speed or other data directly or indirectly reducible to shaft positions. Operating torque is given as less than ½ in./oz, with shaft speeds to 100 digits per revolution available. Taller & Cooper, Inc.

47—DRAFTING MACHINE speeds ideas into drawing

Among advantages announced for the Glideline Drafting Machine are unobstructed board coverage; elimination of machine overhang; ability to work



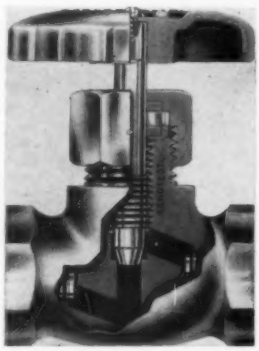
with drawing board at any angle, without need for changing counterweights or counterbalances; controls conveniently located for one-hand operation; and instant, accurate angle settings with automatic 15-deg indexing. Standard models for board coverage range from 24 by 30 to 48 by 96 in., and vertical wall board units to 8 ft by 30 ft. The Glideline is constructed of stainless steel and aluminum. Glideline Corp.

48—HOT PIPE INSULATION for underground applications

The "b-t-u," an underground hot pipe insulation system, consists of integral waterproofing admixes in combination with specially graded aggregates and Portland cement. According to manufacturer, it has high mechanical strength, load-bearing and thermal characteristics, and is extremely resistant to water penetration. It is designed and especially suited for locations with good ground water conditions and firm soil. Z-Crete Div., Zonolite Co.

49—NEEDLE VALVE for use as gage, and for metering

Designated Type N-28, this globe type needle valve is for use as a gage or for metering service in gas, oil, water lines or other similar uses. It has been developed for applications where



space is a factor and where operating areas are close. The valve features a one-piece solid forged carbon steel stem with Teflon packing. Short and compact, this valve is available in four sizes from ⅛ to ½ in. It has a maximum working pressure of 10,000 psi at 70 F, a maximum operating temperature of 500 F. Kerotest Mfg. Co.

50—INTEGRATOR totalizes fast changing variables

This continuous integrator, over a period of time, totalizes rapidly changing process variables convertible into an electrical signal. Its principal use, according to company, is in chemical and refining operations to measure all power consumed in the electro-deposition of metals and for chromatography in measuring the relative quantity of component parts in gas mixtures Records of variables such as tempera-

G-B SNAP-ON DISTRIBUTORS

(See ad on facing page)

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CHICAGO, E. C. Carlson Co.
CINCINNATI, R. E. Kramig & Co.
CLEVELAND, The Miles Materials Co.
COLUMBIA, S. C., Southern States Iron Roofing Co.
COLUMBUS, Santeler Brothers
DALLAS, Insulation Supply Co., Inc.
DAVENPORT, Republic Electric Co.
DENVER, Gene Wright Lumber Co.
DETROIT, Coon-DeVisser Co.
EL PASO, Insulation & Specialties Co.
FARGO, N. D., Smith, Inc.
FT. SMITH, Ark., Gunn Distributing Co.
FT. WAYNE, Ind., M. H. Hilt, Inc.
FT. WORTH, The Bracken Co.
GREENSBORO, N. C., Starr Davis Co., Inc.
GULFPORT, Miss., Paine Supply Co.
HOUSTON, Precision Insulation Co.
INDIANAPOLIS, Central Supply Co.
JACKSON, Miss., Paine Refrigeration Supply Co.
JOPLIN, Mo., Joplin Cement Co.
KANSAS CITY, Kelley Asbestos Co.
LITTLE ROCK, Gunn Distributing Co.
LOS ANGELES, Western Fibrous Glass Products
Thorpe Insulation Co.
LOUISVILLE, General Insulation & Roofing Co.
MEMPHIS, John A. Denie's Sons Co.
MIAMI, Southern States Iron Roofing Co.
MINNEAPOLIS, Asbestos Products, Inc.
MOBILE, Ala., Shook & Fletcher
NASHVILLE, Southern States Iron Roofing Co.
NEWARK, N. J., Eastern Steam Specialty Co.
NEW HAVEN, Conn., Insulation Supply Co.
NEW ORLEANS, Eagle Asbestos & Packing
NEW YORK, Eastern Steam Specialty Co.
OKLAHOMA CITY, Ball Distributing & Engineering Co.
OMAHA, Cardinal Supply & Mfg. Co.
PHILADELPHIA, John F. Scanlan, Inc.
PITTSBURGH, Dravo Corp.
PHOENIX, Ariz., Kircher Asbestos & Rubber Co.
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RICHMOND, Va., Southern States Iron Roofing Co.
ROCKFORD, Ill., Mott Brothers Co.
SALT LAKE CITY, Bullough Asbestos Supply Co.
SAN ANTONIO, The Bracken Co.
SAN DIEGO, Western Fibrous Glass Products
SAN FRANCISCO, Western Fibrous Glass Products
SAVANNAH, Ga., Southern States Iron Roofing Co.
SEATTLE, Western Fibrous Glass Products
SOUTH BELOIT, Ill., Mott Brothers Co.
ST. LOUIS, A. G. Brauer Supply Co.
ST. PAUL, Asbestos Products, Inc.
SYRACUSE, N. Y., Industrial Supply Co.
TAMPA, Fla., Eagle Roofing & Art Metal Works, Inc.
TALLAHASSEE, Fla., Baker's, Inc.
TULSA, Okla., Ball Distributing & Engr. Co.
TUPELO, Miss., Paine Supply Co.
WASHINGTON, Walter E. Campbell Co., Inc.
WICHITA, Jamar-Olmen Construction Co.
VANCOUVER, B. C., Fleck Brothers Limited

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. . . and he'll tell you it's the perfect insulation for plant piping. Easy to cut. Easy to snap on. Flexible. Clean and dustfree. Reusable. Light as a feather. And don't forget—this one-piece pipe insulation molded of fine glass fibers has the *highest thermal efficiency* of any insulation for cold or hot piping up to 350°!

Snap*On is available in one-piece sections . . . in sizes up to 33" . . . plain or with a complete range of factory-applied jackets for appearance, vapor barrier or weatherproofing. It is stocked by a nation-wide network of G-B distributors. See adjoining column for name of your local distributor or write for complete information.

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Yes, the few extra pennies you put into longer-burning Duro-Test lamps repay you in lighting dollars saved. Duro-Test lamp users buy fewer replacements and spend less for maintenance.

Here's the reason why. Duro-Test lamps far outlast conventional lamps because they are more carefully built of stronger, finer components and they're specifically designed for heavy industrial and commercial service.

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The Duro-Test lighting expert in your area will be glad to show you how you can benefit by the unequalled performance and dollar-saving durability of Duro-Test lamps. Write for lighting catalog today.

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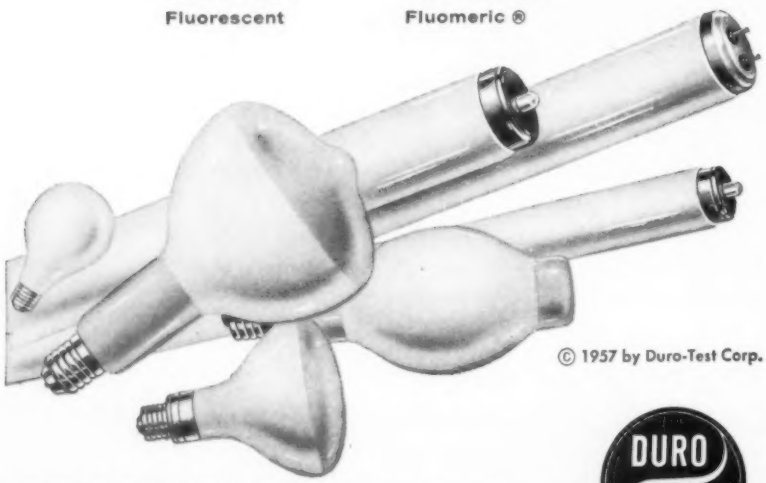

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DURO-TEST CORPORATION

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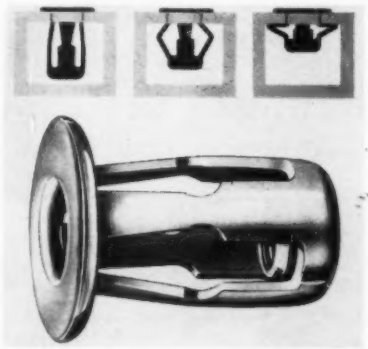
NEW PRODUCTS

(Begins on page 168)

ture, flow, pressure, kilowatts and Btu's can be integrated on strip or chart recorders with transmitting slidewires having a linear output and a resistance between 20 and 250 ohms. The instrument, which can be added to a recorder regardless of control features, reads out the integration on a six-digit counter and on the chart record by means of a dual pipping pen. Accuracy of the integrator is given at ± 0.5. The instrument case fits standard relay racks (19 in.) or can be panel or wall mounted. Minneapolis-Honeywell Regulator Co.

51—BLIND FASTENER cuts costs, speeds assembly

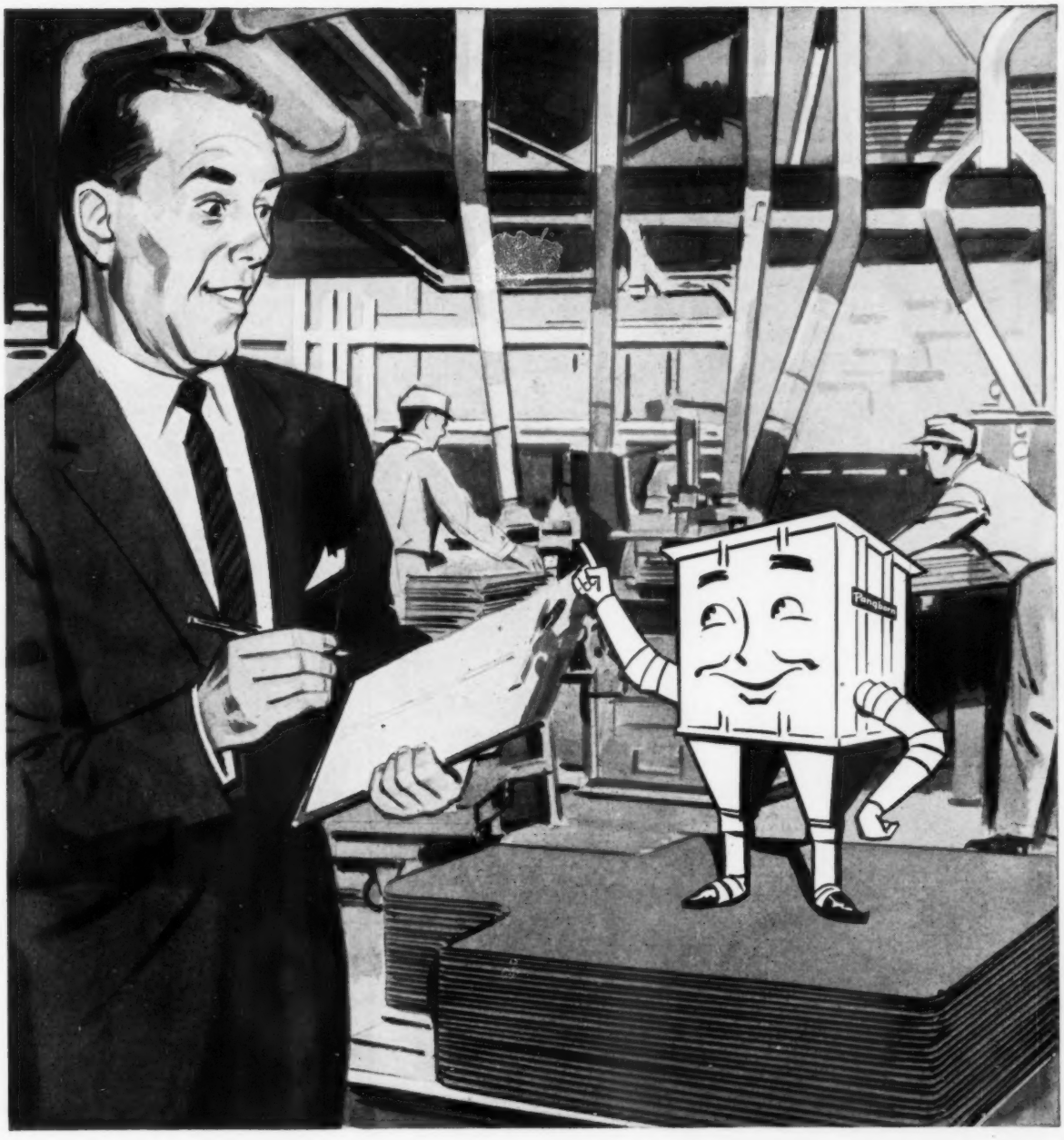
The Jack Nut is described as the only blind fastener with threads which securely grips any kind of material from 0 to 3/8 in. thick. It is self-adjusting to grip evenly on rough and curved surfaces as well as on smooth and level ones. Jack Nuts can be used as rivets



and/or blind fasteners in expansion space as small as 3/8 in. Manufacturer says they provide firm nutplates for attachment screws, and anchorage is permanent, permitting screws to be removed and replaced. Jack Nuts are reported to make vibration-proof assembly with weight-carrying capacity limited in most cases only by strength of material in which used. Jack Nuts allow holes to be fashioned before, during or after fabrication, it is pointed out; they do not require special holes and hole size is not critical. Nuts come in a short length for thicknesses from 0 to 3/16 in., and a longer length for 0 to 3/8 in. Molly Corp.

52—BUS DUCTS offer several design improvements

Improved design low impedance feeder and plug-in bus ducts are supplied with totally enclosed, ventilated or weatherproof housings. Design of the new



"You don't say! Step up production 10%?"

But we do say! Many firms have discovered that Pangborn Dust Control in their plants has effected a definite increase in employee efficiency. By trapping dust at the source, Pangborn Dust Collectors keep air clean, help maintain good working conditions. Individual productivity can go up 5%, 10% or more . . . resulting in higher overall production by healthier, happier employees.

What's more, Pangborn gives you other benefits of lower housekeeping costs, longer machinery life, extra profits from any salvage value and better community relations. And Pangborn Dust Control offers a complete line of collectors for all jobs.

Why not discover how you can profit from Pangborn Dust Control? Write for Bulletin 922 to: PANGBORN CORP., 3200 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Dust Control & Blast Cleaning Equipment.*

Pangborn CONTROLS DUST

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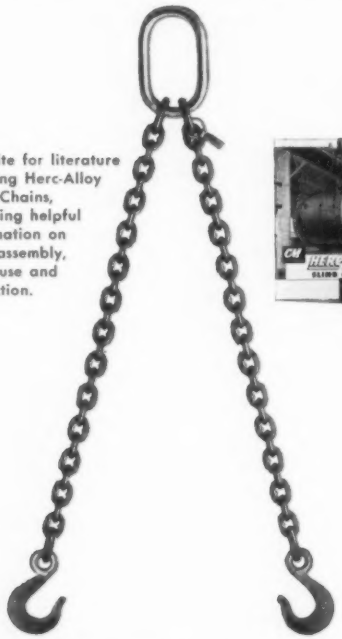
HERC-ALLOY

SLING CHAINS

● Herc-Alloy is the only exact-size alloy chain on the market. This uniformity gives you a lighter and easier-to-handle chain without any sacrifice in working load limit.

● Herc-Alloy, the original alloy steel chain, is available in running lengths as well as in all types and sizes of slings made to customer specifications.

● Write for literature covering Herc-Alloy Sling Chains, including helpful information on their assembly, care, use and inspection.



● CM also produces a complete line of chain attachments and welded chain of all types including stainless steel and bronze.

Hammerlok® COUPLING LINKS

● Assemble or rebuild your own Herc-Alloy sling chains with all components furnished by your local distributor. Hammerlok is simple, safe, reusable. New Herc-Alloy assemblies can now be ordered with welded or Hammerlok Coupling Links as desired.

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NEW PRODUCTS

(Begins on page 168)

bus ducts permits assembly of tees and elbows during installation to meet particular plant needs. Self-supporting bus bars are secured in place on 11-in. centers by means of phenolic blocks. Bus bars are arranged with integral plug-nuts at one end and slotted holes at the other to simplify alignment and bolting. Extra slotted holes and plug nuts are provided at each joint to facilitate on-location assembly of tee at the splice between standard 10-ft duct sections. It is noted that heavy current take-off devices can be bolted on bus at any time without disturbing splice between installed sections. Three sides of the housings are welded to provide strength, and covers are bolted for accessibility to bus assembly. Announced as UL listed and meeting NEMA standards, this bus duct comes in ratings from 600 to 4000 amp. Federal Pacific Electric Co.

53—SWIVEL PAD for leveling machine tools, racks,

This large-diameter (1⅞ in.) swivel pad is designed for leveling machine tools, electronic racks, benches, etc. The pad swivels 10 deg each side of

the center line and adjusts automatically to unevenness in the floor surface. The tapped hole permits vertical adjustment of the pad for leveling purposes. The ball of the leveling pad is hardened to prevent galling and helps form its own seat in the pad. The pad is cadmium plated and irridited for resistance to rust. Vlier Engineering, Inc.

54—DAYLIGHT PAINT warns against radiation

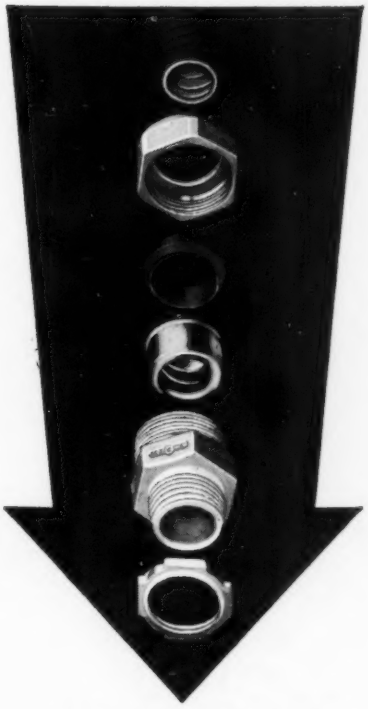
Radiation Purple Sunbonded Day-Glo Paint has been developed especially to increase effectiveness of the radiation warning symbol used to mark all radioactive areas and equipment and areas where radiation danger exists. While meeting requirements of the

GEDNEY

TOPS THEM ALL!

...in malleable iron quality
...in accurate machining
...in smooth-fitting threading

ROCK-BOTTOM INSTALLATION COSTS... specify Gedney. Machined and threaded with utmost accuracy... smooth-finished, with no metal particles or burrs ... made of the best malleable iron to eliminate breakage... individually inspected to insure absolute top quality. For today's lowest installation cost... specify Gedney!



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The most dependable liquid-tight connectors available today. For use with "SEALTITE" and equivalent Liquid-Tite Flexible Conduit. Designed to give wiring absolutely dependable protection against water and oil. Built for lifetime service. Available in sizes ⅜" to 2"... straight... 45° and 90°.

90° CORNER ELLS
Top-quality Malleable Iron, cadmium plated. Fitted with gasketed cover. Both ends female. Available in a full range of sizes from ½" to 2".

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Top-quality Malleable Iron, cadmium plated. Fitted with gasketed cover. One end male, one end female. In sizes from ½" to 2".

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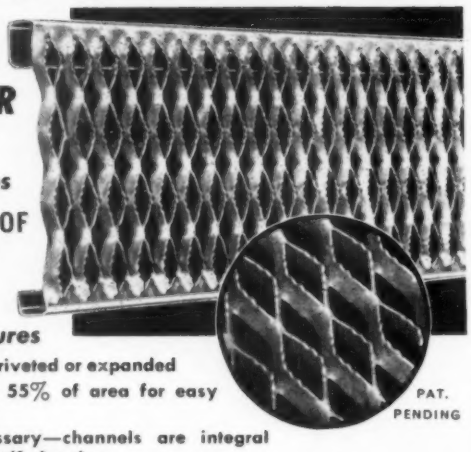
two superior open steel
FLOOR GRATINGS
BY GLOBE

1 Safety GRIP-STRUT®

FOR MAXIMUM SAFETY ALL OVER YOUR PLANT



Important Safety Features

★ FIRE PROOF ★ SLIP PROOF
★ MAXIMUM STRENGTH
★ MINIMUM WEIGHT

Important Economy Features

★ All one piece, not welded, riveted or expanded
★ Open space in excess of 55% of area for easy access of light and air
★ No extra supports necessary—channels are integral part of the material. ★ Self cleaning
★ Cut and installed like lumber by your own maintenance force. ★ Low in original cost. ★ For balconies, no secondary sprinkler heads needed

PAT. PENDING

Ideal for work platforms, stair and ladder steps, flooring, balconies, catwalks, machinery guards, fire escapes and for original equipment safety treads.

2 GOLD NUGGET® WELDED grating
PAT. PENDING

The QUALITY GRATING for Heavy Duty Applications

★ 3/16" projection weld nugget for greater rigidity and strength
★ Vertical alignment of the main load bar assured
★ All bars are load carrying bars including secondary bars
★ Anti-skid pattern

PROJECTION WELD

Each secondary load bar (A), as projected welded to the primary load bar (B) has a shear strength of 5,000 pounds per weld. There are 28 such projection welds to a square foot of grating. This means that GOLD NUGGET Welded Grating can sustain greater shock loads than other gratings.

For the complete details of these revolutionary new gratings, write for new catalogs today. Distributors in all principal cities. Consult the yellow pages in your phone book under "GRATING".

108

PRODUCTS DIVISION
The GLOBE Company MANUFACTURERS SINCE 1914
4016 SOUTH PRINCETON AVENUE • CHICAGO 9, ILLINOIS
For more facts circle 603 on Reply Card

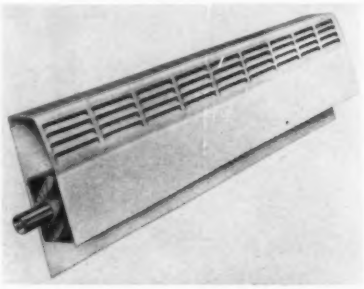
NEW PRODUCTS

(Begins on page 168)

ASA Safety Color Code for "vivid reddish purple" this paint is claimed to be startingly brighter in daylight than the non-fluorescent purple. According to announcement, fluorescent color offers the further advantage that it is readily distinguishable as radiation purple when viewed at distances which would make most colors appear white, grey or black. The new color comes in an aerosol spray container, as a brush and spray paint, and as a silk screen process speed dry paint. Switzer Brothers, Inc.

55—BASEBOARD assembles by snapping together

Designed primarily for commercial and industrial installations using hot water or steam, the BFOT Baseboard can be assembled by snapping components together. Other features in-



clude easy cleaning without removing cover, improved circulation of cold air from windows without heat loss, low first cost and lower installation cost. Baseboard has heavy gage steel cover, angular louver grilles, heating elements in steel tube and steel fin and copper tube and aluminum fin designs for medium and high output applications. Lever-operated or knob-operated damper is optional. Dunham-Bush, Inc.

56—TRUCK BATTERIES offer higher capacities

Types HC and CMS are higher-capacity motive power batteries designed to equip electric industrial trucks with increased power. Their increased capacity is attributed to use of longer, heavier plates and company's Five-Fold Slyver-Clad construction. The Type HC has the same over-all dimensions as the industry's former standard of 60 amp per positive plate, and will supplant company's Type HA, a 66-amp-hr cell by providing in the same space a rated capacity of 72 amp-hr per positive plate when discharging at its 6-hr rate, manufacturer announces—a gain of about 10 per

NEW! NEW! NEW! NEW! NEW!...

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ALL TYPES OF FLUIDS

Now . . . in one condensed catalog . . . you have a quick reference to the complete line of Fulflo and CFC Filtration Equipment. Continuous micro-clarity means lower maintenance costs, improved product quality and stepped-up production.

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PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

MICRO-CLARITY AT MINIMUM COST

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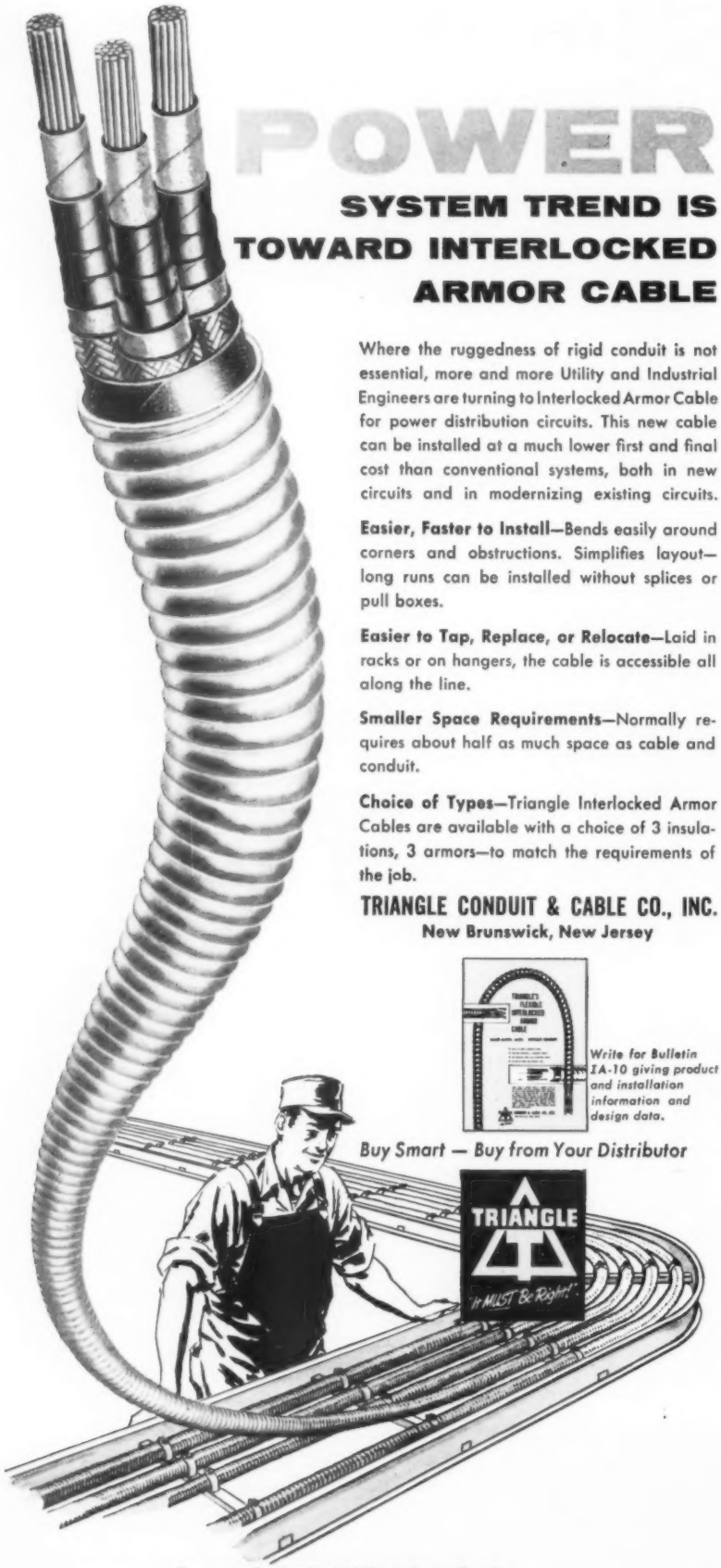


POWER

SYSTEM TREND IS TOWARD INTERLOCKED ARMOR CABLE

Where the ruggedness of rigid conduit is not essential, more and more Utility and Industrial Engineers are turning to Interlocked Armor Cable for power distribution circuits. This new cable can be installed at a much lower first and final cost than conventional systems, both in new circuits and in modernizing existing circuits.

Easier, Faster to Install—Bends easily around corners and obstructions. Simplifies layout—long runs can be installed without splices or pull boxes.

Easier to Tap, Replace, or Relocate—Laid in racks or on hangers, the cable is accessible all along the line.

Smaller Space Requirements—Normally requires about half as much space as cable and conduit.

Choice of Types—Triangle Interlocked Armor Cables are available with a choice of 3 insulations, 3 armors—to match the requirements of the job.

TRIANGLE CONDUIT & CABLE CO., INC.
New Brunswick, New Jersey

Write for Bulletin IA-10 giving product and installation information and design data.

Buy Smart — Buy from Your Distributor

TRIANGLE
"It MUST Be Right!"

For more facts circle 605 on Reply Card

NEW PRODUCTS

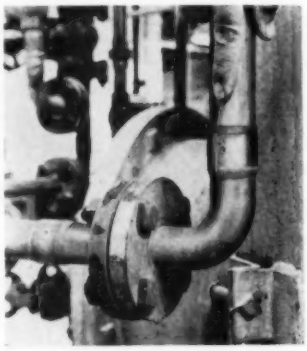
(Begins on page 168)

cent. The battery is interchangeable with existing truck battery compartments designed to accommodate batteries with an over-all height of 22⅝ in. in steel tray without cover; 23¼ in. in steel tray with cover for motorized hand trucks, and 24⅛ in. for steel tray with cover for driver-ride trucks.

The Type CMS line, having a rated capacity of 55 amp-hr per positive plate at the 6-hr rate, is especially designed for application to "low silhouette," "safety silhouette," or "low profile" type of center control sit-down model fork trucks having over-all collapsed mast heights of 72 in. C & D Batteries, Inc.

57—CONNECTOR simplifies stainless pipe welding

Stainless steel piping can be welded quickly by using a new aligning connector, according to manufacturer. The connector fits over ends of connecting sections permitting in-place pre-assembly of pipe and fittings, and



helps to align the system. Another advantage cited is elimination of icicles inside connections. Connectors are designed for use with lightwall stainless steel pipe, schedules 5 and 10 and Speedline fittings. They also connect with conventional schedule 40 systems. Since lightwall piping systems eliminate threading at joints, excess pipe wall is not needed to provide thickness required for screwed joints. Speedline Div., Horace T. Potts Co.

58—LAMP BALLAST for appliance fluorescent lamps

The 6G1050 is an appliance fluorescent lamp ballast featuring stronger terminals and a 5 per cent increase in starting current over company's previous models. Ballast terminals are built to withstand an 18-lb push-or-pull force and a 10-lb rotational force. The stronger terminals help reduce ballast

(Begins on page 168)

rupture during installation, according to company. Faster starting of appliance fluorescent lamps is claimed possible because the ballast starting current has been increased. Ballast mechanical and electrical characteristics permit complete inter-changeability with company's 89G611 unit, which it supersedes. It is available in 14-, 15- and 20-w, 118-v ratings. General Electric Co.

It's easy to obtain product data with the postage-free Reader Service Cards provided on pages 213-214. Use them for information on advertised products, too. Just circle the key number appearing at bottom of the ad.

59—SHOP UNIT is combination desk and work bench

This combination work bench and desk is made for those common repair, test, and light assembly jobs that require both paper work and mechanical operations. Under its metal edged, Masonite top are two shallow drawers —a narrow one for paper and a wide

drawer, subdivided into 24 compartments, for parts and small tools. Two extra-large file drawers below accommodate blue prints, circuit drawings, instruction manuals, etc., and two open storage shelves provide space for bulky fixtures, test equipment and extra supplies. Drawers may be inserted from the back to reverse the kneehole position. The 54-by-25 in. desk top is 36 in. high. Legs are fitted with adjustable glides for easy leveling. Neubauer Mfg. Co.

60—BURGLAR ALARM is versatile, easily operated

An electronic burglar alarm and control system, the Electro-Sentry is claimed to provide three-dimensional

BUY

ALL TRIANGLE PRODUCTS LOCALLY FROM YOUR ELECTRICAL DISTRIBUTOR

It's smart today to buy all your electrical needs — wire, conduit, cable, switches, fittings — from your nearby distributor. One call shopping saves you time and money.

Your distributor's warehousing saves you countless cubic feet of valuable floor space, and assures you of a constant flow of fresh materials as your schedules demand.

Your distributor gives you

Fast delivery . . . on one item or a hundred— from one manufacturer, or from many.

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Low inventory cost . . . his stock is your inventory control, gives you working capital.

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That's why dependable electrical manufacturers advise you to always buy from YOUR DISTRIBUTOR — THE BEST FRIEND YOUR BUSINESS CAN HAVE! He's the one source for everything electrical — and he's local.

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TRIANGLE
"It MUST Be Right!"

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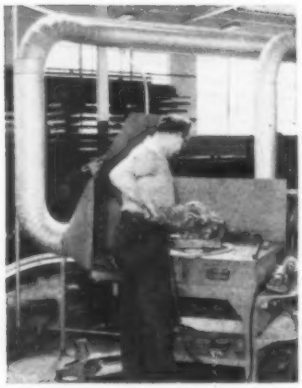
AIR IN MOTION KEEPS MEN IN MOTION

Dusty or fume-laden air can curtail production and increase maintenance costs by dulling worker efficiency and damaging bearings, motors . . . even machines.

Efficient K & B Dust Control Systems put AIR in Motion to become an important production tool.

In the plant of a noted chain and forging firm, an official made this comment about a new K & B installation: "Our workmen can now work full time . . . this means added production for them and for the company as well."

Call on K & B engineers to put *AIR in Motion* and help boost your plant efficiency. The Kirk & Blum Manufacturing Company, 3189 Forrer Street, Cincinnati 9, Ohio



K & B system serving castings grinding removes dust, sand and chips as fast as they are produced. Work revolves on turntable to enable operator to work continuously.

50 YEARS OF SERVICE

KIRK & BLUM

DUST CONTROL

K & B Down Draft Dust Control System in plant of The Monarch Machine Tool Co., Sidney, Ohio

For more facts circle 607 on Reply Card

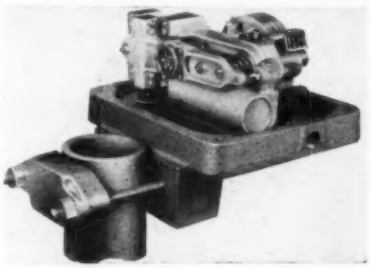
NEW PRODUCTS

(Begins on page 168)

protection. Suggested applications include operating automated components and systems, monitoring uses such as warning people when approaching hazards, activating devices. In addition to being connected to a central police warning system, the control unit can also be connected directly or through relays to alarms such as bells, whistles, sirens and horns. Visual warning is indicated on the face panel of the console after the signal pattern has been disturbed. The Electro-Sentry is described as capable of operating with four sensing units, each with a 25-ft radius range. Gulton Industries, Inc.

61—TRANSMITTERS measure temperature, pressure

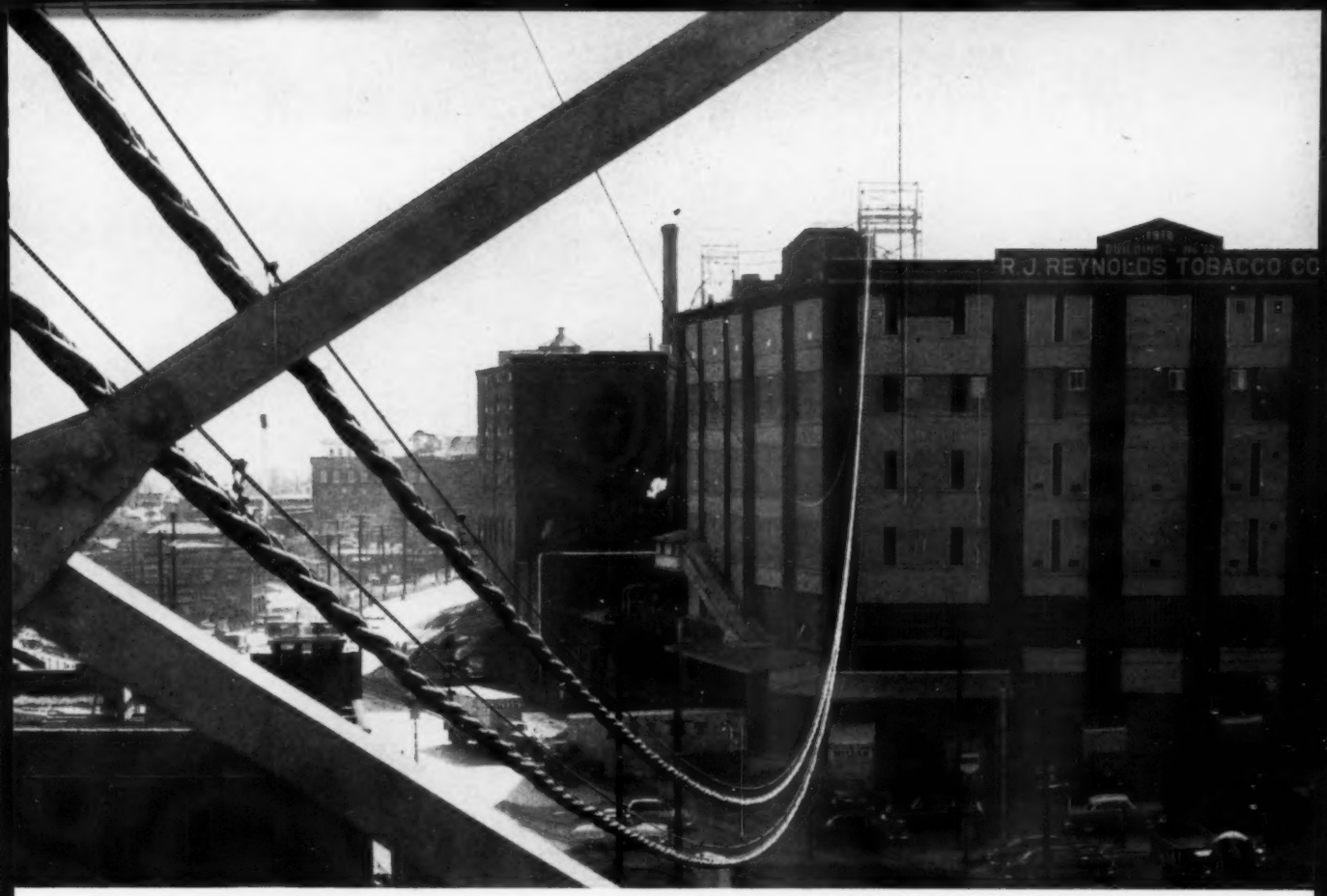
Designated Series 4600 for temperature and Series 4700 for pressure, these transmitters are pneumatic force-balance devices employing gas filled thermal systems for temperature measurement and bellows elements for pressure. An outstanding feature is said to be their "balanced beam" design which permits mounting in any position without positional error. Unit



sub-assembly construction is used throughout, permitting removal of sub-assemblies without disturbing beam assembly. Thermal systems and pressure elements are readily removed for change of range span. A derivative unit, which compensates for lags in the thermal system, can be added on underside of baseplate, and requires no tubing or fittings. There is also a special provision for an integral receiver gage to be mounted directly on baseplate, without external connections. Bulletin 214 gives data. Mason-Neilan, Div., Worthington Corp.

62—ALLOY BAR protects fuel storage tanks, burners

Magna-Bar was designed to eliminate varnish and sludge in heating oils, and to reduce corrosion of fuel storage tanks. The device is a bar of alkaline alloy metal about 4 in. long. It can



Okolite-Okoprene aerial cables furnish a low-cost route for increased power demands over a span of 420 feet between buildings.

More power the low cost way ...with Okolite-Okoprene aerial cable

To meet the power demands of increased cigarette production, The R. J. Reynolds Tobacco Company of Winston-Salem, North Carolina, recently installed the two Okolite-Okoprene aerial cables shown here. An operating voltage of 15kv and a span of 420 feet across two open primary lines and railroad sidings called for aerial cables with maximum reliability. Okolite-Okoprene self-supporting cable was used, with extra messenger for added safety.

Here is another case where an Okonite self-supporting aerial cable solved an increased power-demand problem simply and economically. The overhead route often costs much less than the underground route . . . and it can be just as safe, too, when you use dependable Okolite-Okoprene cable. Recommended for general use up to 35kv, Okolite-Okoprene is insulated by Okonite's exclusive strip process and (if rated at over 2kv) inspected inch-by-inch on the Gooding Test Train.

Okonite is the only manufacturer making cables by all insulating methods: strip, extrusion, tape or dip. Thus we are in the unique position of being able to recommend to you without prejudice the one cable which most closely meets your requirements. The Okonite Company, Passaic, New Jersey.

Look for us at Booth No. 232, Plant Maintenance Show—Chicago.

where there's electrical power . . . there's **OKONITE CABLE**

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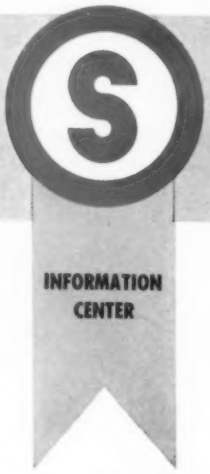

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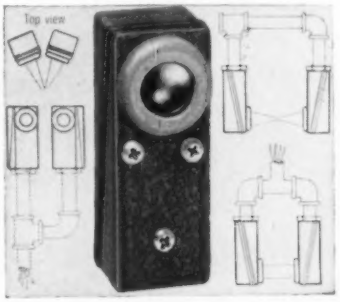
NEW PRODUCTS

(Begins on page 168)

be quickly installed in an oil storage tank, and is suspended from a wire attached to tank cap. The cap, wire and Magna-Bar come as a unit and two types are available for indoor and outdoor or underground tanks. It achieves its effect by a chemical reaction in which varnish and sludge-forming catalysts and corrosive acids formed in tank are neutralized. It is explained that corrosion that does occur attacks the alkaline alloy bar, rather than the tank. Johns Mfg. Co.

63—PHOTOELECTRIC HEADS for hard-to-reach spaces

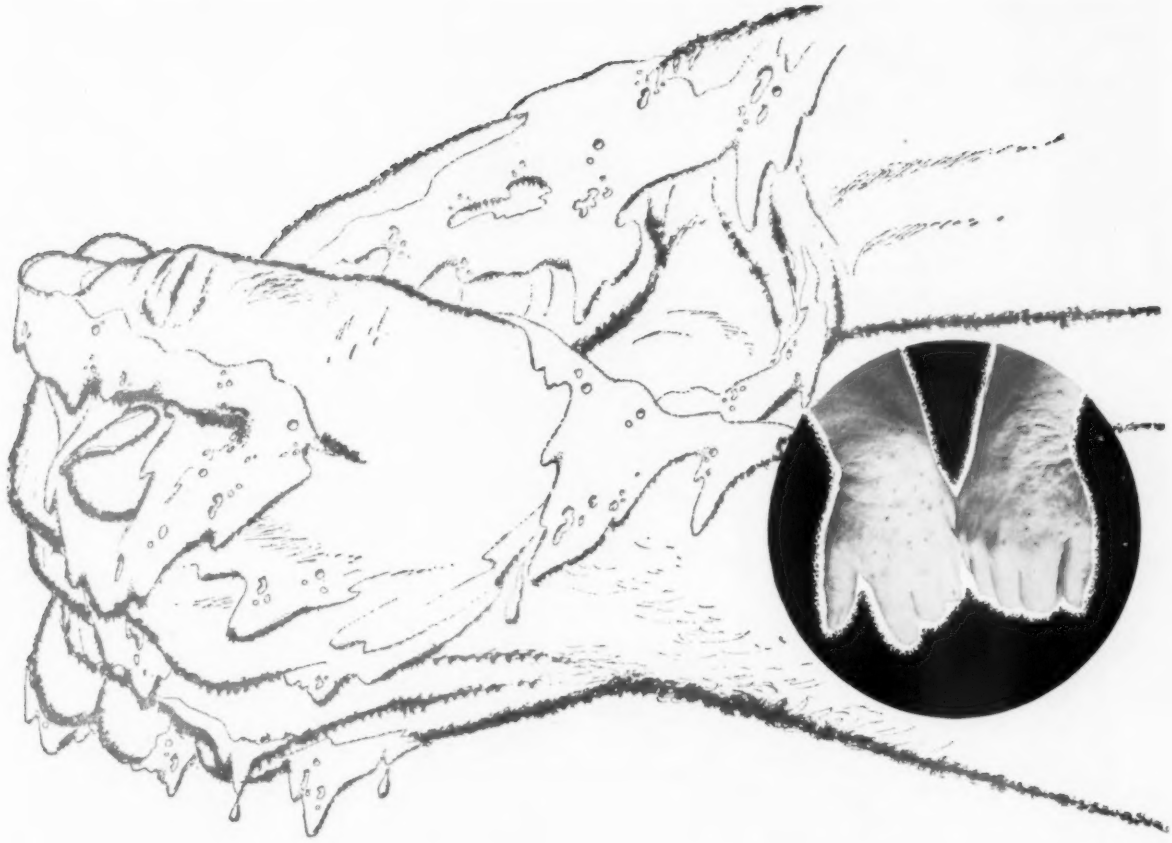
For convenient positioning, particularly in limited or hard-to-reach space, these small phototube and light source heads are housed in 1 7/16 by 1⅜ by 3⅝ in. gasket-sealed cast aluminum



cases. They screw on to ½-in. pipe or conduit for both support and wiring, which simplifies rigid mounting in practically any position or location. Heads are also available with 6-foot flexible armored cables. Heads can be used to actuate a wide range of photoelectric controls as well as photoelectric timing controls. The light source head has a straight fixed light beam conservatively rated from 30 ft-candles at 5 ft to 2 foot candles at 14 ft. Autotron, Inc.

64—TEMP SCANNER provides multi-point protection

This versatile multipoint temperature scanner is designed to provide over or under-temperature protection for systems where it is mechanically or economically desirable to provide one temperature alarm instrument capable of sensing several control points and providing alarm if one of these temperatures exceeds or fails to reach a pre-set limit. From four to 56 thermocouples are connected to a stepping switch which samples the output of each thermocouple. The signal is then



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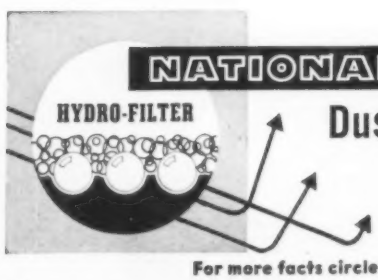
EFFICIENT. Turbulent area of water, bubbles and mist assures constant, sustained air water contact.
EASY MAINTENANCE. Dust never comes in contact with dry surface. Sludge is settled, removed automatically. Glass spheres are self-cleaning.

Hydro-Filter offers real simplicity to wet collection problems

Simplicity is the *success* of the National Hydro-Filter and is why it offers constant dust collection efficiency to the micron range *combined* with low operating costs and maintenance that amounts to but *minutes a month!*

Look at the photo—Every inch is *active* space. There is nothing to clog, no baffles to "load up" and reduce efficiency. Water, air and glass spheres do the work and a constant flow of water carries contaminants to the sludge tank where they are automatically ejected.

Sound simple? . . . It is, and the whole story on Hydro-Filter is contained in a comprehensive bulletin that is available on request. Write for your copy today.



Dust Collector Corp.

604 Machinery Hall Bldg.,
Chicago 6, Illinois
Subsidiary of National Engineering Company,
Manufacturer of Simpson Mix-Mullers.

For more facts circle 612 on Reply Card

NEW PRODUCTS

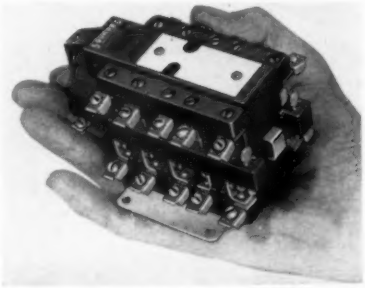
(Begins on page 168)

delivered to the signal terminals of a contact meter.

As long as each temperature is below (or above) the limit established on the contact meter, no alarm is sounded. If any of the points scanned should be beyond the set-point, an alarm is sounded and a light corresponding to the offending thermocouple remains lit and scanner is stopped at that point. The alarm can be located close to points monitored or at a more remote location. Scanning rate can be as rapid as ½ sec per point, but scanning rates providing 5 to 60 sec of dwell time on each thermocouple are more practical, according to manufacturer. Tipptronic, Inc.

65—10-AMP RELAY now available in a 10 contact size

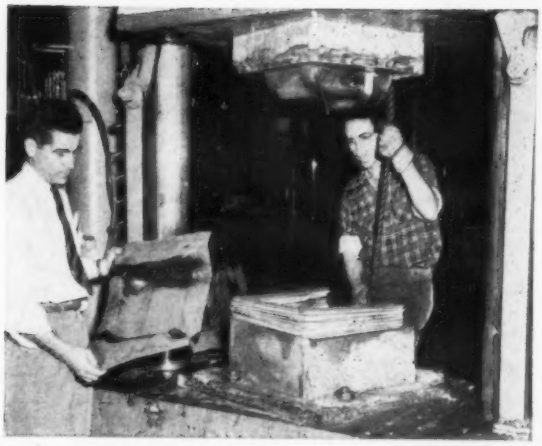
Previously available in two sizes, four and six contact, Class 8501, Type D, 10-amp relays are now available in a 10-contact size, with a maximum of



six normally-open and 4 normally-closed or eight normally-open and 2 normally-closed contacts. The relay measures only 5 in. high by 3 in. wide. All three sizes of the relay have identical mounting hole dimensions for ease of electrical panel planning and interchangeability. Bulletin 8501-D gives complete story. Square D Co.

66—INSULATION installs quickly with no tools

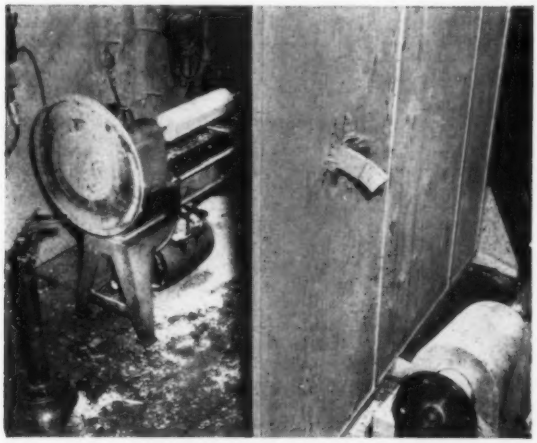
Tests of Scorbord are reported to show labor savings up to 50 per cent as compared with many competitive forms of perimeter and cavity wall insulation. Scorbord is a black, smooth surfaced board of expanded polystyrene 1 in. thick, 2 ft wide and 8 ft long. The labor saving, according to manufacturer, results from the fact that no tools and little time are needed on the job to fabricate Scorbord to size. Three prominently marked striations have been cut the length of each board at the 3-, 12- and 20-in. marks across the width. This lets you snap off



LOW COST

Fir plywood templates cut progressive tooling costs 75%

Fir plywood templates like this have reduced progressive tooling costs in forming parts with depths of about 12" by over 75 per cent at Ryan Aeronautical Co., San Diego. The total savings run into thousands of dollars. Deep drawn metal parts like these are commonly made with a series of sand cast metal dies, but they are highly expensive where only a few identical parts are required. Ryan switched to plywood for this and similar operations, and found it stands up well under the continuous blows of drop hammer forging.



STRONG

Rugged fir plywood screen saves life at Douglas Aircraft

Fir plywood's tremendous impact resistance paid off by saving a man from death or crippling injury at Douglas Aircraft, Santa Monica. This fir plywood temporary partition, ordered into place by plant safety engineers, stopped a part hurled from a fast spinning lathe only a few inches from a workman's head. The force was sufficient to have ripped right through ordinary lumber, metal or composition panels of comparable size and weight. Because of its outstanding strength, low-cost and easy workability, fir plywood is ideal for barriers, screen and machinery guards.

DURABLE

Fir plywood spacers last twice as long as hardwood

A switch from select hardwood to Exterior fir plywood for spacers required in zinc electrolysis has sharply lowered replacement costs at Consolidated Mining and Smelting Co.'s British Columbia plant. Where the hardwood lasted only 90 days, Exterior fir plywood stands up for 180 days. The fir plywood spacers are three inches wide and ¾ inch thick. They are used to separate anode and cathode plates in 1,000 tanks which carry a 10 per cent sulphuric acid solution.

FIR PLYWOOD

DFPA TESTED QUALITY

Letters DFPA on panel back or edge attest manufacture and inspection under industry-wide quality control program. Individual grade-trademarks are specification guides to the right type and grade and the *right* quality.

FOR INFORMATION about specific plywood uses, or for basic specification-use data, write (USA only) Douglas Fir Plywood Association, Dept. 180, Tacoma 2, Washington

For more facts circle 613 on Reply Card

(Begins on page 168)

widths of 3, 4, 8, 9, 12, 17, 20 and 21 in. as well as utilize the original 24-in. width. The seiection of sizes is considered ample for most standard foundation perimeters and other cavity wall applications.

Like other products in manufacturer's Styrofoam family, Scorbord is light in weight, waterproof, chemical resistant, and offers sufficient structural strength to permit pouring of concrete slabs on it. It will be available at no increase in price over Styrofoam. The Dow Chemical Co.

67—DUST COLLECTOR for difficult dust conditions

The redesigned P-17 Cycoil is an oil bath aftercleaner developed for collecting dust particles that may escape conventional dry centrifugals or viscous impingement filters. Its efficiency suggests its use for cast iron machining, production metallic grinding, and tool room equipment grinding. The P-17 Cycoil is described as an automatic, self-cleaning collector that separates dust from air as it passes through a viscous crimped-wire, fluid bed pad. Dust-laden air is mixed with the oil by a perforated plate over which oil flows from a central point.

Upward flow provides holding force required to keep a large quantity of oil in the fluid bed pad, and the latter is so designed that collected oil droplets drain to perimeter—out of the air stream. This washing action serves to keep the pad clean and the dirty oil flows back to the tank where dust particles settle out as sludge and oil is recycled to the Cycoil. A separate oil reservoir and sludge tank permits easier sludge removal, it is noted and the collected dust can be removed periodically while the Cycoil is in operation. American Air Filter Co., Inc.

68—WALL SYSTEM utilizes aluminum and gypsum

This movable interior wall system combines aluminum framing and four-ply gypsum wall panels. Ten extruded aluminum shapes, designed jointly by Vaughan Movable Interior Walls, Inc., and Kaiser Aluminum & Chemical Corp., are used for base and ceiling closure plates, runners, jambs, mullions, fillers, partition and glazing

stops. All sections are 6063 alloy with a satin-like finish. The wall systems are reported to cost about half that of many types of movable walls and their design permits custom fitting on the job. Both walls and framing sections can be dismantled and reinstalled. The gypsum panels permit numerous decorating finishes and materials, including wood laminates. Also, the framing enables use of glass panels. Basic gypsum panels are 2 ft wide by 2¼ in. thick, each panel consisting of two 2⅝-in. thick inner sheets faced with ½-in. sheets. All four sheets are laminated on the job. This construction is claimed to provide a sound reduction of 40 decibels and 1-hr fire rating. Vaughan Movable Interior Walls, Inc.

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Realock engineers will cooperate with you in planning all details. Complete information and free estimates available. Consult your classified directory or contact the nearest sales office listed below.

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THE COLORADO FUEL AND IRON CORPORATION

BRANCHES IN ALL KEY CITIES

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NEW BOOKS

for the plant engineer

Industrial Trucks

THE HANDBOOK OF POWERED INDUSTRIAL TRUCKS. Size 11 by 8½ in. approx; 92 pp including index; illustrated; loose-leafed with plastic backbone. Published by The Industrial Truck Association, 900 F. Street, N.W., Washington 4, D.C. Price $5.00.

NEARLY THREE YEARS went into the preparation of this authoritative handbook on industrial trucks. It has been designed to answer the needs of maintenance and material handling personnel as well as of those in purchasing, operation and production activities.

There are five sections in the book, namely industrial truck applications, cost savings through industrial truck handling, planning for and selection of industrial trucks, industrial truck engineering data, and industrial trucks and the future.

Liberal number of illustrations show various types of trucks, attachments, containers and load carrying devices. In addition, the publication includes engineering tables, graphs, and an extensive maintenance check list.

In the engineering section of the book there is information pertaining to both internal combustion engine powered trucks and battery powered units. A discussion on LP gas included in this portion mentions some of the advantages and disadvantages of using this type of fuel.

Protective Lighting

AMERICAN STANDARD PRACTICE FOR PROTECTIVE LIGHTING. Size 11¼ by 8¼ in.; 20 pp; illustrated; paper bound. Published by Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y. Price $0.50.

THIS IS a guide for the application of protective lighting. In the booklet are presented the principles of security illumination encompassing a number of points which are desirable for effective lighting.

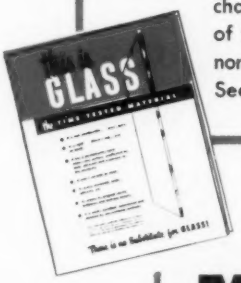
The bulletin includes information on: floodlights, street lights, Fresnel units, and searchlights. Electrical distribution and control is treated also.

Among the tables in this publication there is an extensive one on the

Wire glass is *the only glazing medium* that can successfully withstand the fury of the flames in this dramatic Underwriter's Laboratory test. To qualify as Fire Retardant No. 32 the glass is first subjected to temperatures ranging up to 1600° F, and later to a ¾" stream from a fire hose at 35 to 40 lbs. pressure. Passing the test requires that the glass remain in the sash substantially unchanged except for cracking due to thermal shock. For positive protection that no glass substitute can offer, insist on Mississippi Wire Glass, the *original* upon which the Underwriters' standard was based in 1899—the standard today by which all others are judged.

Insist on GLASS *for Glazing*

Glass and glass alone possesses the desirable characteristics of chemical stability, permanence of finish, color and shape, surface hardness and non-inflamability. Buy—specify—insist on glass. See your Mississippi glass distributor.



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NEW BOOKS

typical equipment for protective lighting; it has illustrations showing various types and other material.

Modern Chemistry

MODERN CHEMISTRY FOR THE ENGINEER AND SCIENTIST. Published by McGraw-Hill Book Co., Inc. Price $9.50.

THIS BOOK is based on one of the extension lecture courses presented at the Los Angeles campus of the University of California. It contains material on the advancements in the science of chemistry and its industrial applications. Contributors to this book have summarized accomplishments and newer methods in various fields.

A remarkable array of petrochemicals from crude oil is suggested in one discussion. Many of the contributors relate current principles of physiology, engineering and chemistry. Isotopic tracers which are of importance in industrial testing and studies are treated in the contents.

Among some of the other topics are the following: crystal chemistry and pyrochemistry of clay materials; new developments in food technology; carbon-fluoride compounds; and chemical kinetics and fast reactions.

Thermodynamics

ENGINEERING THERMODYNAMICS BY ROLF H. SABERSKY. Size 9¼ by 6¼ in; 318 pp including index; illustrated; cloth bound. Published by McGraw-Hill Book Company, Inc., 330 West 42nd St., New York 36, N. Y. Price $7.50.

IN THIS BOOK, the basic laws of thermodynamics are presented and discussed. Among the cycles taken up in this work are those pertaining to: the simple gas turbine, gas refrigeration, and jet propulsion.

It is advisable for prospective students of this book to have completed courses in differential and integral calculus.

Some of the other topics in the book are: design of a nozzle for a given pressure ration; typical combustion reactions and exhaust-gas analysis; the Venturi meter; the energy equation; and velocity of sound in compressible flow.

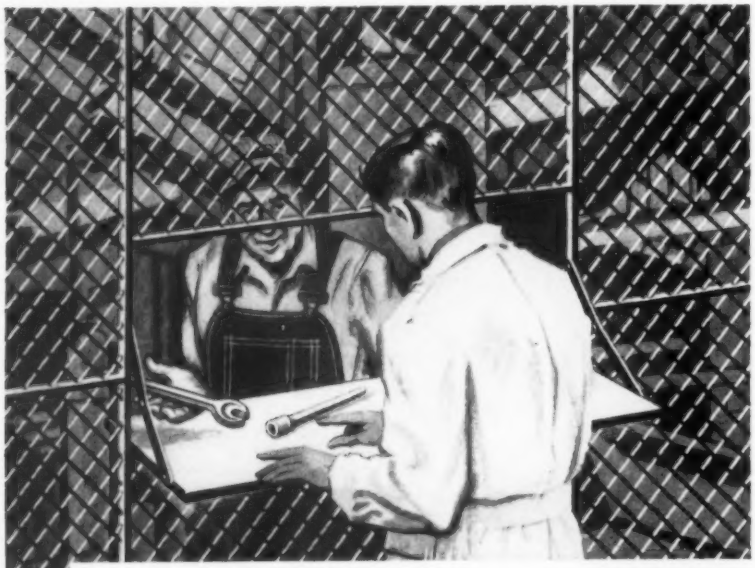
The appendix contains references for further study along with steam tables, a Mollier diagram, and gas charts.

Pumps

CENTRIFUGAL AND AXIAL FLOW PUMPS by A. J. Stepanoff. Size 9¼ by 6⅛ in.; 462 pp including index; illustrated; cloth bound. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, N. Y. 16, N. Y. Price $12.00.

NEW TOPICS dealing with theory, design and application are treated in the second edition of this book. The major additions of information include a chapter on water hammer problems, material on the thermal cavitation criterion, a new viscosity chart, and complete characteristics of axial and mixed flow pumps.

Among the nineteen chapters in the book are the following: hydraulic performance of centrifugal pumps; leakage, disc friction, and mechanical losses; special operating conditions of centrifugal pumps; shaft design for critical speeds; and water-hammer problems in centrifugal pump systems.



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Do you know that employee theft of company-owned tools, supplies, etc. totals more than 200 million dollars per year? That's right! . . . and *your* company is paying a portion of that "bill". That's why you'll find low-cost Phoenix wire mesh partitions one of the best investments you can make. For simply by erecting Phoenix partitioning around your tool rooms, store rooms and other such areas, you will *substantially* decrease the "mysterious disappearance" factor that even now is costing your company untold sums of money. And your savings in reduced theft losses will, *in fact*, pay for your Phoenix partitioning many times over. Want more details? Write today for the new Phoenix bulletin on Wire Mesh Partitions. It's yours for the asking!

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Millions of square feet of Corrugated ASBESTONE "400" have served for years as curtain walls and roofing on plants in all climates, under every type of industrial condition. ASBESTONE "400" allows wide latitude of design—with the durability and permanence of stone.

For technical data on Gold Bond® Corrugated ASBESTONE "400"—or for assistance from our Estimating and Engineering Service—write Dept. PE-18, National Gypsum Company, Buffalo 2, New York.

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BUILDING PRODUCTS

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2. Only Jam-Proof die stock—automatic kick-out after standard thread is cut by hand or power.
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See 65R-TC before you buy—at your Supply House

The Ridge Tool Company, Elyria, Ohio, U.S.A.

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Plant Explosion Hazard—Dust

(Continued from page 127)

provide free of charge, pamphlets which should be studied by those whose work involves materials with potential dust explosion hazards.

At some point along the line in the material handling of granular or pulverized materials there may be a condition calling for caution. Chuted sulphur may build up a static charge initiating an ignition in a storage bin or in the hold of a vessel. A fragment of steel may strike a spark in the heavily dustladen air within a hammer mill casing. Ignited dust at this point is particularly dangerous as an adjacent inclined belt conveyor housing provides an ideal draft duct.

A rubber belt of a bucket elevator may build up a static charge. Static-free belts are available.

The turbulence in the collecting hoods and centrifugal separator of a pneumatic ventilating system may set up the dust-air proportions favoring ignition by static spark.

The operation of flame-cutting and welding equipment may initiate dust ignition. Repairs involving the use of flame or heat should be made when dust-producing equipment is idle and the locality cleared of dust. Where static electricity charges are detected these should be eliminated by grounding wires or brushes. Static sparks in dust clouds are extremely dangerous.

There are two considerations in these problems: the control of the risk and the reduction of the violence of the explosion should it occur. Venting to dispel the pressure build-up within the plant is advisable. The Bureau of Mines suggests vents in the form of fragile panels on equipment, hinged windows or panels in building walls, skylights and special ventilators.

As a general rule, one square foot of vent area should be provided for each 80 cu ft of volume, if the explosion to be vented is of the type of low rate of pressure rise. Where the dust being produced is capable of producing an explosion with a medium rate of pressure rise, the ratio should be one square foot of vent to 40 or 50 cu ft of volume. For a potentially high rate of rise, the maximum possible venting area should be provided—one square foot for each 15 or 20 cu ft of volume. This may mean a breakable wall or roof. **End**

Here's How Selective Plating

(Continued from page 129)

from the rectifier clamped to the blade, the strip is swabbed with the Dalic cleaning solution for about three minutes until the steel is really bright in appearance.

Following a careful water rinse, the plating stylus is substituted in the anode lead and again the area is swabbed, this time with the zinc plating solution. During both the cleaning and the plating operations, the rectifier is set at 19 volts and the stylus is kept moving uniformly over the area to be treated.

Plating continues until the rectifier registers two ampere-hours, when the blade is again rinsed and the thickness is checked with a Krouse gage. Minimum plate thickness: 0.001 in. The same procedure is then repeated on the other side of the propeller blade.

Individual trays catch the cleaning or plating solution which drips off during each process. This avoids

mixing, and the solution can be reused after simple filtering. To make sure the solutions are at a usable strength and are giving consistent results, one test panel each day is coated to a thickness of 0.0006 to 0.0008 in. The panel is tested for pin-holes, uniformity and general appearance.

One of the major advantages in the use of this equipment lies in the safety factor. A sensitive circuit-breaker will shut off the rectifier immediately should a short circuit occur, to avoid burning of the surface metal or the danger of a shock to the technician. Also, selective area plating is easily mastered with a minimum of operator training. The only requirement is that the areas to be plated are "brushed" fairly evenly, so that they are kept moist with electrolyte. **End**

New Plant Construction

(Continued from page 162)

new facility is scheduled for the latter part of 1958. An outstanding production feature will be the electronic, punch card controlled, automatic proportioning system for batch mixing of feeds.

Baltimore, Md.—Kennecott Copper Corp., 161 E. 42nd St., New York, N. Y., plans to construct an electrolytic copper refinery. Construction of the refinery will begin at once and will have an initial capacity of 7000 tons of electrolytic refined copper per month. Plant will be built at an estimated cost of $20 million and should be finished in mid-1959.

Alma, Mich.—Leonard Refineries, Inc., Thomas and E. Superior Sts., plans to add a fluid catalytic cracking plant to its refinery here. Installation will cost approximately $3 million when completed in the spring of 1959. Ralph M. Parsons Co., 617 S. Olive St., Los Angeles, Calif., has been awarded the construction contract.

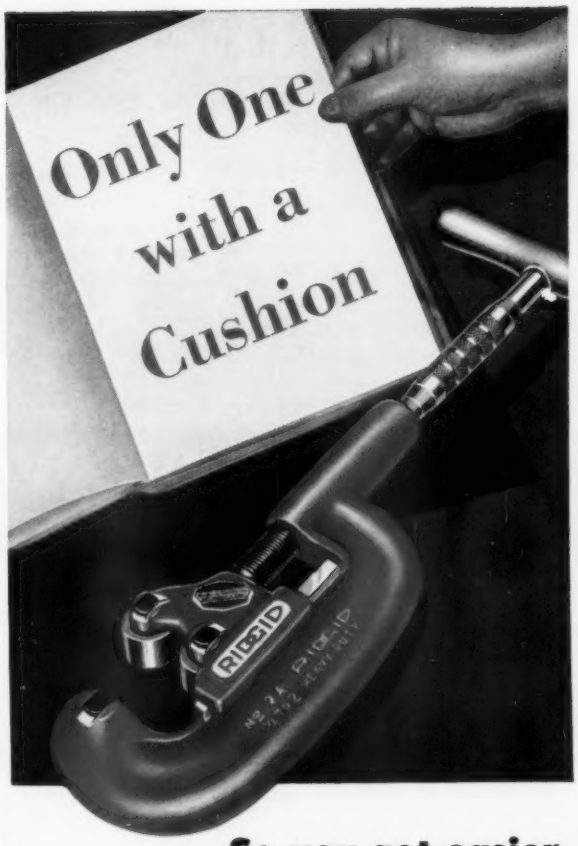
Henderson, Nev.—Stauffer Chemical Co., 382 Madison Ave., New York, N. Y., plans to construct a multi-million dollar plant for the production of trithion, an organic phosphate pesticide developed by company. Work on the new facility has already begun and will be in operation by late 1958.

Toms River, N. J.—Ciba Co., 631 Greenwich St., New York, N. Y., producers of dyes, intermediates and textile resins, plans to construct a large plant for the production of epoxy resins. A development laboratory also is planned adjacent to the plant. Work on both projects will begin soon for completion by late 1958.

Albuquerque, N. M.—Dewey Portland Cement Co., 424 Nichols Rd., Kansas City, Mo., plans to erect a large cement plant near here. Work on the new plant will proceed as soon as engineering plans are completed and will have an anticipated output of 1,250,000 bbl of cement annually. Cost of the project will be in excess of $10 million.

Syracuse, N. Y.—Crucible Steel Corp. of America, Oliver Building, Pittsburgh, Pa., will construct a new applied research laboratory at company's Sanderson-Halcomb works, here. Laboratory will be a field research facility operating as an extension of the company's central research and development center here. It will be part of a $1.5 million expansion program at the plant.

Beaver Falls, Pa.—Babcock & Wilcox Co., 161 E. 42nd St., New York, N. Y., plans expansion of its alloy and stainless steel facilities at company's tubular products division. Plans call for the addition of a new electric arc furnace and associated equipment. New facilities will be constructed near an existing company building at Koppel, Pa. Additional facilities will cost between $12 and $14 million.



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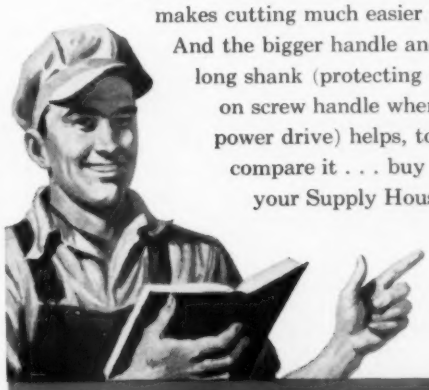
The instant you start feeding in this new cutter on a pipe you feel the remarkable difference, the new cushioning effect that makes cutting much easier and faster. And the bigger handle and extra long shank (protecting threads on screw handle when you use a power drive) helps, too. Try it, compare it . . . buy it at your Supply House.



The Ridge Tool Company, Elyria, Ohio, U. S. A.

For more facts circle 619 on Reply Card

INDUSTRIAL FILMS

Wood for School Construction

ENTITLED "The Massapequa Story: Two Schools for the Price of One", this new film is based on a recent telecast on a successful wood school case history. The film contains a kinescope film recording of the actual telecast, which covered many schools in the community.

Also included are interviews with the architect of the Massapequa schools, the president of the board of education, the superintendent of schools and the principal of one of the schools.

NLMA's film version of this telecast is introduced by Dr. Walter D. Cocking, editor of The School Executive and American School and University, and a well-known authority on schoolhouse construction.

Prints of "The Massapequa Story", in black-and-white and with a running time of 12½ minutes, are available at $50 each from National Lumber Manufacturers Association headquarters, 1319 18th St., N.W., Washington 6, D. C.

A limited number of loan prints for which there is a waiting list, has been set aside for preview purposes.

Band Saw Machining

"TOOLING THE BAND SAW for Production" describes the versatility of the band saw in the accurate removal of metal and shows how these machines provide a new concept of machining operations requiring shaping, slotting, splitting or facing. It depicts slotting of hydraulic pump indexing fixture for moderate pro-

rotors with the aid of a simple duction and more elaborate fixturing for automatic operation, examples that typify the many machining applications that can be done on the production band machine. For loan of the 16 mm color, sound film that runs 10 minutes, write to The DoAll Company, Des Plaines, Ill.

Precision Handling and Control

PRECISION CONTROL, demonstrated by setting down one pound of a nine-ton load, corking a bottle and cracking eggs with the same load and swinging a pyramid of water filled goblets on a steel slab, is the subject of "Hydro-Magic" a 16 mm sound-color motion picture.

All these demonstrations are performed with a truck-mounted Hydrocrane.

The film, No. S-406, is available on loan from Bucyrus-Erie Company, Publicity Dept., South Milwaukee, Wis.

SLY CONVEYOR OVENS...

Sly direct gas-fired ovens dry moisture from strip steel. A typical load is shown at the right side of the photo. Each oven is 20'8" long, 9' wide, 7½' high. Maximum temperature is 450° F.

Completely Automatic Operation Speeds Drying of Steel Strip

The Sly Ovens at an eastern specialty steel producer are a typical example of how careful Sly engineering provides lower initial and operating costs while meeting stiff production requirements.

The ovens dry moisture from coiled strip steel at a combined rate of 20,000 pounds per hour. Floor-type conveyors automatically move the truckloads of steel through four stations on a regular time cycle. At each 7½-minute interval, the air-operated doors lift up. As one truck moves out another comes in. Thus all stations are always occupied.

A uniform temperature is assured by the properly sized and located ductwork, and an exhaust fan provides for positive moisture removal.

Economy of operation, space-saving design, efficient materials handling, close temperature control — all these advantages and more are yours when you specify Sly.

WRITE FOR BULLETIN 200 — it describes the complete Sly line.

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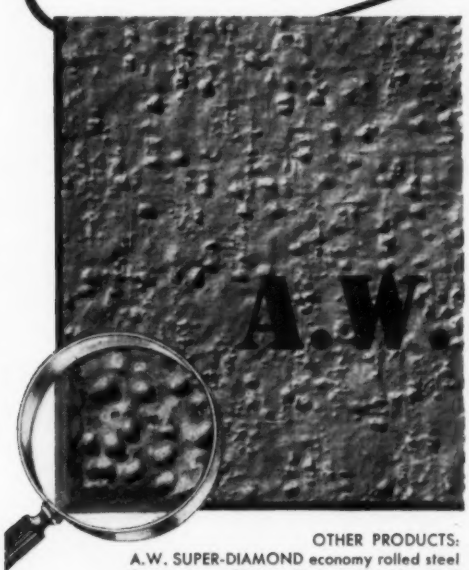
Ma'm'selle has not made the slip once, since she installed A. W. ALGRIP!

Other slips . . . maybe, but never one on A.W. ALGRIP. Ma'm'selle has learned that A.W. ALGRIP won't slip . . . no matter how wet the surface. And if Ma'm'selle owned your plant, no doubt she would install A.W. ALGRIP . . . all ze way aroun'! There are many advantages.

Yes, anywhere you install A.W. ALGRIP, you can forget about slippery surfaces. Hazardous slipping conditions disappear. Work efficiency increases while accident rates and insurance costs drop.

A.W. ALGRIP Rolled Steel Floor Plate is made by a patented process in which a grinding wheel type abrasive is rolled—*not coated*—to a controlled depth, as an integral part of tough steel plate. Wear merely exposes more abrasive . . . safety lasts for the life of the installation.

Check your plant for slipping hazards. A.W. ALGRIP provides super-safe footing under the most hazardous conditions—even on inclined surfaces. Send coupon for A.W. ALGRIP information, today.



OTHER PRODUCTS:
A.W. SUPER-DIAMOND economy rolled steel floor plate—Plates—Hot and cold rolled sheet and strip—(Alloy and Special Grades)

A.W. ALGRIP ABRASIVE ROLLED STEEL FLOOR PLATE

ALGRIP—*approved for safety by Underwriters' Laboratories*

ALAN WOOD STEEL COMPANY
Conshohocken, Pa.

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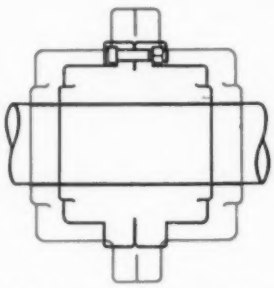
Compactness - -
it's the big difference in geared flexible couplings



Link-Belt geared couplings (black) are smaller, lighter, yet highly capable—provide dependable performance plus savings in space and cost.

These features assure coupling reliability:

1. **SOCKET HEAD FLANGE BOLTS** of hardened steel with ground body securely join housing halves. Locknuts prevent loosening in operation.
2. **FIBER GASKET** fits tightly between flanges. Lubricant can't escape.
3. **PRECISION-CUT** gear teeth have controlled clearance to allow for normal misalignment—minimum backlash.
4. **ALL-STEEL CONSTRUCTION** with properly proportioned parts assures sturdiness, long life operation.
5. **QUAD-RING SEALS** are exceptionally effective in retaining the lubricant. Gearing is always submerged in oil, assuring long, trouble-free operation.

That's why LINK-BELT geared flexible couplings transmit more hp per coupling dollar

COMPACTNESS and high load capacity make Link-Belt geared flexible couplings your best answer for economical power transmission. Size for size, they will accommodate larger, more powerful shafts than other flexible couplings.

These couplings are all-steel and accurately machined for dependability and long life. Hardened flange bolts are ground for close fit. Socket type bolt heads require less of the coupling diameter to be used in the flange—more is available for larger gears and larger shafts.

Compact and rugged—these couplings offer exceptional durability to cope with shock, pulsation, reversing loads and misalignment. For facts, contact your Link-Belt office or authorized stock-carrying distributor. Or write for Folder 2775.

For more facts circle 622 on Reply Card

LINK-BELT

GEARED FLEXIBLE COUPLINGS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World.

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BULLETINS

101	102	103	104	105	106	107	108	109	
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BULLETINS

(Begins on page 21)

CONSTRUCTION

147 Slope Beam Roof — This 8-pp bulletin contains detailed drawings illustrating various applications of this slope-beam roof system, described as ideal for flat roof construction. Also featured are complete slope beam and purlin specifications as well as load capacity tables. The Steelcraft Mfg. Co.

148 Use of V-Girders — Eight-pp Catalog G-57 gives data on use of company's V-girder as a structural framing member for 40- to 76-ft spans. Explains how this V-girder provides a strong floor and roof support and illustrates available types. Includes load tables and V-girder nomenclature. Macomber Inc.

149 Panel Skylights—The 1958 issue of this annual catalog contains up-to-date information on a line of aluminum and fiber glass skylight products. All models and designs, as well as major installations, described. The Marco Co.

150 On Vinyl Tile—Illustrated in full color, this catalog introduces Duraco, a vinyl industrial floor tile. Provides product characteristics, brief specifications, color chart and pictures of product uses. Azrock Floor Products Div., Uvalde Rock Asphalt Co.

151 Expanded Metal, Grating—Bulletin 20-4, 8 pp, illustrates applications of expanded metal in plant construction and maintenance as well as the manufacture of many articles. Includes size data, air flow tables, and load capacities of the grating type. Joseph T. Ryerson & Son, Inc.

METALS

152 Steel Bars—"Effect of Copper, Abnormally Heavy Drafts, Furnace Treatment and Die Practice on Stress-proof Steel Bars," is the subject of this 12-pp engineering report. Discusses chemistry of raw material used in production of steel bars, and explains how controlled addition of copper results in an increased machinability; better tool life, and improved resistance to wear and corrosion. Various tests to determine wear resistance are outlined, and curves, charts and tables included. La Salle Steel Co.

153 Stainless Steels — This bulletin describes briefly the properties of 17-4 PH and 17-7 PH stainless steels. Corrosion resistance, high strength, workability and hardenability at low heat-treating temperatures are some of the points covered. Typical applications are listed. Armco Steel Corp.

TOOLS, WELDING

154 Tools, Attachments — Provided in this 32-pp catalog are listings and prices of manufacturer's full line of tools for automatic screw machines and turret lathes, as well as information and instructions relative to their proper use. Among several tools introduced in this book are an "on and off" center drilling attachment, a tool holder for multi-spindle automatics, a combination swing tool, and swing tool and knurling attachments for turning tools. R and L Tools.

155 Spiral Point Design—The "spiral point" concept in drill point geometry and the "Spiropoint Drill Sharpener" for applying it to standard twist drills are described and illustrated in 16-pp Publication SP-57-1. Performance and design details are fully treated. Cincinnati Lathe and Tool Co.

156 Power Tool Guide — Thirty-pp Catalog 105 describes 70 portable electric tools and kits with over 400 accessories. Buying guide includes pictures of tools and their applications with complete specifications and prices for electric saws, sanders, drills, planes, routers, shapers, and combination tools. Porter-Cable Machine Co.

157 Resistance Welding Control — Bulletin GET-2683, 12 pp, furnishes electrical and mechanical information on standard components comprising non-synchronous welding control. Diagrams, charts and schematic drawings clarify applications and operation details. General Electric Co.

158 Weld Insert—Form 9574, 12 pp, describes a method of pipe joining that uses a consumable weld insert when welding is possible from one side only. Fifteen different insert compositions are classified for the welding of carbon steels, austenitic stainless steels, nonferrous alloys, and chrome-moly and chrome steels. Arcos Corp.

159 Welding Supplies—Presented in Catalog 9-13 are 48 pp of information on welding supplies and accessories. Among items covered are ferrous and non-ferrous welding rods for oxy-acetylene welding and Heliwelding, welding and brazing fluxes, aluminum welding fluxes, silver brazing alloys, and such protective equipment as goggles, glare protection spectacles, welding helmets and face shields, hard hats, leather welding gloves. Electrode holders and cable connectors, weld cleaning tools, are described. Air Reduction Sales Co., Div. Air Reduction Co., Inc.

160 On Seam Welding—Bulletin SP-7A, 16 pp, contains technical data on seam welding low-carbon and stainless steels. Charts, macrophotographs of welds, production photos and text cover this specialized welding from material preparation to weld testing. Also included are details on welding techniques and production speeds, use of interrupted and continuous current on low-carbon steels, welding dissimilar thicknesses, roll spot welding calculations. The Taylor-Winfield Corp.

WATER TREATING

161 Ion Exchange Treatment—This Fact-File-Folder discusses the importance and advantages of water treatment by ion exchange and describes water treating equipment, deionizers, demineralizers, dealkalizers, softeners and filters. Applications of the various items are pictured and described, and a large fold-out section shows typical installations. H. M. Mueller Corp.

162 Tray Deaerator — Bulletin 28B-8853 describes a tray type deaerator for effective removal of corrosive gases from boiler feed water. Includes description of the cycle of operation of the tray deaerator, six typical storage arrangements, and provides standard tray deaerator information Allis-Chalmers Mfg. Co.

163 Hot Process Softeners—Among information contained in 24-pp Publication 4800 is a section on the conditions of water that make treatment necessary. Subjects covered in this section are reduction of silica, foaming, priming, and problems of protection against corrosion. Various types of hot process equipment are described and photos, drawings and diagrams are included. Cochrane Corp.

INSTRUMENTS, CONTROLS

165 Electronic Process Control—Series A-801 including four bulletins features details on company's electronic process control instruments for indicating, recording, and controlling temperature, pressure, level flow, pH, etc. Tables of specifications are included with statements of proportional band, reset and rate performance, spans and adjustability. One bulletin covers Unitized Autronic Control in general; other bulletins are on controller, manual control unit, and recorders and indicators. The Swartwout Co.

Postage-free Reader Service Cards make it easy to order catalogs. Cards are provided on the facing page.

166 Industrial Electronics — New ideas in electronics for industry are presented in 12 pp, "Industrial Electronics For You." Illustrated is company's complete line of electronics equipment for automatic control of resistance welders, automated machine tools, precision test equipment, safety equipment, etc. Also described are firm's facilities for engineering and electronic research. Robotron Corp.

167 For Temperature Control—Six-pp Bulletin 655 shows how to select, size and order temperature control valves. Includes information on selecting proper body material, valve trim, thermal system, etc. Detailed but simple formulae and examples are used. Jordan Corp.

168 Basic Controls—Nine basic types of temperature and pressure controls are described in this 12-pp condensed catalog. Covers self-operating regulators, water mixing equipment, pneumatic control instruments, indicating and recording instruments and control valves. Equipment is designed for industrial process control, also for heating, ventilation, and air conditioning systems, and hot water service applications. Powers Regulator Co.

BULLETINS

(Begins on page 21)

169 Versatile Indicators — Bulletin MSP-134, 8 pp, describes company's MSP Indicator, a versatile multi-point instrument for measuring a complete range of draft, pressure, and differential. Photos illustrate component features, and sections on types of elements, mounting diagrams are included. Hagan Chemicals & Controls, Inc.

170 Pneumatic Controllers—Twelve-pp Catalog 53P-4000 discusses motion-balance pneumatic controllers with regenerative feedback circuit. Covers controller response characteristics and includes cutaway drawings illustrating design and construction features, selection data, dimensions and specifications. Fischer & Porter Co.

171 High Vacuum Gages—Bulletin 9-1, 24 pp, describes a broad line of high vacuum gages, including an absolute manometer, thermal gages, ionization gages, and a combination thermal-ionization gage. Pertinent data is given in a graph of pressure ranges and a gage data table. Detailed descriptions of the various types of gages in the line are included. Rochester Div., Consolidated Electrodynamics Corp.

172 Rate-of-Flow Controller—Bulletin 900, 12 pp, contains data on details of design, capacities, dimensions, and typical installation of company's Type S rate of flow controllers. Included are dimensional diagrams as well as specifications. Simplex Valve & Meter Co.

173 Rate of Flow Instruments—Bulletin M-1 pictures and describes company's line of precision instruments for measuring, indicating, recording, and controlling rate of flow of all types of fluids. Included are detailed descriptions of various types of rotameters. Schutte and Koerting Co.

174 Magnetic O_2 System—Application Data Sheet 463-60 describes company's magnetic oxygen system for flue gas analysis. Components of system are described and system advantages detailed. Leeds & Northrup Co.

175 Speed Measurement Data—Available to plant engineers is Brochure GET-2741 (1, 2, 3, 4) describing four methods of measuring speed to 0.01 percent accuracy through use of company's Type HE potentiometer recorder. Included are four separate bulletins on application of the differential speed recorder; speed ratio recorder; speed deviation recorder; and multi-range expanded scale speed recorder. Other bulletins cover the basic instrument: Bulletin GEC-1377 describes the potentiometer recorder, and Bulletin GEC-1258, the tachometer generator used. General Electric Co.

176 Protective Wells — Complete specifications on wells for thermostat applications in fluids, gases, or high pressure environments are included in this catalog. Describes copper and stainless steel designs for immersion, surface mounting. Fenwal Inc.

DUST, FUME CONTROL

177 Dust, Products Collector—Bulletin 150-A covers company's line of Cyclone, Hi-Spin dust and products collectors. Engineering drawings, complete dimensional tables and full design details. Sprout, Waldron & Co., Inc.

178 Air Pollution Control—Successful applications of catalytic oxidation to four difficult air-pollution control problems are reviewed in this technical reprint. Details actual installations in carbon black, insulation, oil-refining and chemical processing industries—applications where, in addition to gaseous pollutants, aerosols, inorganic dust, and hard-to-oxidize components are encountered. Photos, charts, flow diagrams and bibliographical references provided. Oxy-Catalyst, Inc.

METAL FINISHING

179 Anodes, Plating Chemicals — Twelve-pp Bulletin AC-110 describes and illustrates anodes, anode accessories and chemicals for electroplating and metal finishing. Specifications and recommended applications are given for seven styles of anode bags, three types of diaphragms and eight types of anodes. Bulletin describes salts used in electroplating baths and 13 brighteners used in solutions. Line drawings tell how to order hooks for anodes. Hanson-Van Winkle-Munning Co.

180 Photo-Forming—Precision etching of metal parts by chemical and electrolytic means is illustrated and described in 8-pp Bulletin 90. In addition to describing the photo-forming process, it lists photo-formed parts, such as filters, strainers for the various processing industries, carburetor strainers, and unperforated specialties such as dials, cams, pointers, linkages, gears, and diaphragms. Superior Tube Co.

OTHER EQUIPMENT

181 Properties of Chemicals—Booklet F-6136, is a 28-pp 1958 guide to physical properties of synthetic organic chemicals covers more than 350 of the chemicals, including 50 introduced since the previous edition. An alphabetical index is provided and for easy reference, chemicals are arranged by related groups with condensed application data. Much of the information is presented in tabular form. Union Carbide Chemicals Co.

182 Woven Wire Products—Catalog 130, 36 pp, presents company's Metaloom woven wire cloth, partitions, grilles, screens, baskets and trays. Specifications and descriptions are included and book is generously illustrated with photos showing weaves. Catalog has a back-cover pocket which holds a handbook of tabulated wire sizes, weights and clear openings, which serves as a handy reference. F. P. Smith Wire & Iron Works.

183 Industrial Wipers—This series of 12 bulletins describes specific uses of industrial paper wipers in various plants. Benefits are cited and typical applications in metals, electronics, chemicals, foods, electrical and other industries pictured. Scott Paper Co.

184 Metal Stitching — This 16-pp booklet gives detailed information on stitching metal to metal or metal to non-metallic materials and illustrates several typical applications. All of the metal stitchers in the line are pictured and detailed drawings and charts giving specifications are included. Book also covers clinchers available to adapt these machines. Acme Steel Co.

185 Uses of Lead — Two leaflets cover application of hard lead sheet for roofing and flashing and use of lead in today's plumbing systems. The former reports on preferred installation methods for new 2½-lb and 3-lb hard lead, an alloy of lead with small percentages of antimony which permits use in thinner sheets without loss of strength. Detailed drawings of flashings for open valleys, stepped sidewalls, chimney caps, cornice coping and through-wall flashings, etc. are included. Other leaflet describes installation methods for lead pipe and fittings. Lead Industries Association.

186 Water Cooled Equipment—Bulletin 2545-AJ57, 14 pp, contains descriptions and illustrations of water cooled doors, frames, reversing valves, and dampers for open hearth construction. In addition, labor and materials saving devices, including the Dolomite machine, Autopour, and ladles additions shown. Blaw-Knox Co.

187 Electric Furnaces, Heaters — Catalog 57, 20 pp, contains illustrated descriptions of laboratory and industrial equipment, including electric furnaces, hot plates, temperature controllers, pyrometers, flask heaters, and magnetic stirring hot plates. Specification and price tables are included, along with other selection details and illustrative data. Thermo Electric Mfg. Co.

188 Steel Smoke Stacks—Advantages of steel smoke stacks are detailed in this illustrated bulletin, along with a list of typical installations. Size and capacity data are given, as well as formula for figuring anchor bolts for self-supporting stacks, formula for figuring guy wire for guyed stacks, and force of wind data. L. O. Koven & Brother, Inc.

189 Tube Coating Oils—Plant engineers involved with procurement, storage and fabrication of welded carbon tubing will receive benefits from the concise information on protective coatings furnished by ERW-TSL 3. It describes in detail various protective coatings and indicates conditions under which such coatings will supply the required protection. Tubular Products Div., The Babcock & Wilcox Co.

190 Safety Equipment — Covering company's line of face and eye protection equipment, 28-pp Catalog 35 illustrates and describes goggles, glasses, lenses, welding helmets, hand and face shields and respirators. Brief descriptive text accompanying each item gives features. Sellstrom Mfg. Co.

191 Thermostat Metals—"Corrosion-Resistant Metals," summarizes test results on various thermostat metals exposed to corrosive environments such as highly humid atmospheres, hot water, salt spray, etc., and describes

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BULLETINS

(Begins on page 21)

the material as observed in actual use. Includes relative cost chart, a comparative thermal deflection graph, and a listing of mechanical and physical properties for eight metals. General Plate Div., Metals & Controls Corp.

192 Plastics in Brief — This 12-pp booklet briefly outlines characteristics and applications of Plaskon plastics and resins for varied uses. Among types covered are melamine, urea and alkyd molding compounds and nylon molding and extrusion compounds, coating resins, as well as various industrial resins. Barrett Div., Allied Chemical & Dye Corp.

193 Filter Separator — This file of data on company's 15-gpm filter-separator includes a check list of 49 industrial and commercial liquids which can be continuously cleaned by the unit —diesel fuels, solvents, refinery control stocks, gasolines, lube oils, boiler feedwater, process intermediates, industrial waters, others. Drawings show installation and dimensional data, attachments, and external details. Richmond Engineering Co., Inc.

194 Plastic Specialties — This 1958 Catalog and Price List contains 78-pp of data on such specialties as Teflon, Nylon, Kel-F, phenolics and Plexiglas in sheets, rods and tubes. Stock materials covered include vinylite, acetate, polystyrene and polyethylene, in all sizes. In addition to the large and varied stock inventory, special compositions of Teflon, Nylon and Kel-F are offered as well as an industrial fabrication service. Allied Plastics Supply Corp.

195 Seamless Mechanical Tubing — Bulletin TB-340A, 8-pp, explains cost and time-saving benefits of seamless mechanical tubing over other forms of stock. Included are descriptions of how seamless tubing is manufactured and finished, and the differences in dimensional tolerances, costs, machinability and surface finishes of various tubing. Tubular Products Div., The Babcock & Wilcox Co.

196 Precision Instrument Parts — Detailed information on precision instrument parts and components is presented in Supplemental Catalog 13, designed as a supplement to company's main catalog. Lists over 2,000 additional precision instrument components such as 24 to 200 pitch spur gears, stock. PIC Design Corp.

197 Permanent Plate Magnet—Bulletin 1071, 8-pp, contains comparative performance charts and graphs showing how to select exact type and size of plate magnet for a particular installation. Complete specifications and other information included. Stearns Magnetic Products.

198 Surface Condensers — General, construction and operation features of company's line of surface condensers are described in Bulletin M-571. A cutaway view shows component features. Southwestern Engineering Co.

DATA FILE of literature for the plant engineer's library

STANDARD CATALOGS, bulletins and handbooks are listed to help plant engineers maintain a permanent data file. To get these free catalogs, circle item numbers of those wanted on postage-free cards provided you on pages 213-214.

CONSTRUCTION

301 Aluminum Building Products — Form AD 285 is a 32-pp catalog covering company's line of aluminum industrial building products. Cites advantages of aluminum, pictures some installations. Installation data, weights, dimensions and roughing-in details are provided on corrugated roofing and siding, V-beam roofing and siding, ribbed siding sheet, perforated corrugated sheet, flat flashing sheet. Aluminum Co. of America.

302 Steel Buildings — Bulletin SX-11557 covers four types of buildings featuring Steelox panel method of construction. Condensed data are given, and drawings and photos illustrating design details included. Armco Drainage & Metal Products, Inc.

303 Partitions and Walls—Low cost sound-absorbing partitions and walls designed for movable and flexible office enclosures are featured in this illustrated bulletin. Dimensional diagrams and specifications are included, also installation photos. GR Products, Inc.

304 Panel Wall Construction — The advantages of company's M-Type Q-Panel walls are outlined in 12-pp Bulletin Q35-55. Includes installation photos, diagrams, specifications, as well as drawings, pointing out structural details. H. H. Robertson Co.

305 Fir Plywood — This 34-pp construction guide contains full-page structural drawings providing basic information on types, grades, and applications of fir plywood. Booklet covers information on floor construction, single and double wall construction, and roof construction. It is designed for maximum simplicity of use and quick reference, bound in notebook form. Douglas Fir Plywood Association.

306 Wire Partitions — The modern, economical approach to plant layout problems is described and illustrated in 8-pp Bulletin P-55 on wire partitions and custom enclosures. Describes important design and construction features, and includes specification data and dimensional diagrams. Wire and Iron Products Inc.

307 Glass for Industrial Use—How glass is used and how to choose the proper type for the application are covered in 12-pp Catalog 56-1. Discusses glass according to function; light diffusion and glare reduction; decoration; protection; and heat absorption. Photos showing various finishes and typical installations are provided, along with performance data, selection and installation tips, light transmissions. Mississippi Glass Co.

308 Roofing and Siding Data—This folder contains Bulletins 2032, 2032A, B, C and D on corrugated Asbestone roofing and siding, stud weld fasteners, staggered joint application and straight joint application. Includes specifications, as well as photos and dimensional drawings showing construction details. National Gypsum Co.

309 Steel Floor Plate — Skid resistance and other advantages of multigrip rolled steel floor plate are stressed in this illustrated bulletin. Also gives dimensions, weights, data on allowable loads. United States Steel Corp.

310 Non-Slip Flooring — Algrip, an abrasive rolled steel floor plate described as non-slip even on steep inclines, is the subject of Booklet AL-29, 8 pp. Discusses safety features; fabricating. Alan Wood Steel Co.

SLINGS, CHAINS AND WIRE ROPE

311 Sling Handbook — The 64-pp Tuffy Sling Handbook is replete with illustrations, charts and diagrams describing 16 factory fitted slings and nearly two dozen standard fittings available for slings, including several which are recent additions to the line. Book contains a complete rigger's manual, shop chart of ratings, an engineer's notebook and standard signals for directing operations of overhead traveling cranes. Union Wire Rope Corp.

312 High-Strength Chain — Bulletin DH-319 describes Accoloy X-Weld 125 chain, said to resist bending, breaking, and kinking. Lists such applications as sling chains, banding chains, load binders, towing chains and boomer chains. In addition to specifications, weights and dimensions, properties and applications of specially manufactured heat-resisting and acid-resisting chains are covered. American Chain Div., American Chain & Cable Co., Inc.

MAINTENANCE

314 Basic-Roofing Information—"What You Should Know About Your Roof" is a 40-pp clearly illustrated booklet which tells what makes a roof fail, how to recognize signs of roof deterioration, what to do to keep a roof in good condition. Discusses recommended roofing practices, essentials of good re-roofing job. Johns-Manville.

315 Handbook on Coatings — This 1957 Coatings Manual is a 32-pp treatise highlighting the stopping and preventing of rust on nearly all types of rustable metal. Illustrated in full color, this book contains information and recommendations to enable accurate determination of specific coatings needed for the job. Basic principle of Rust-Oleum's fish oil penetration into pores of metal is illustrated. Application photos give

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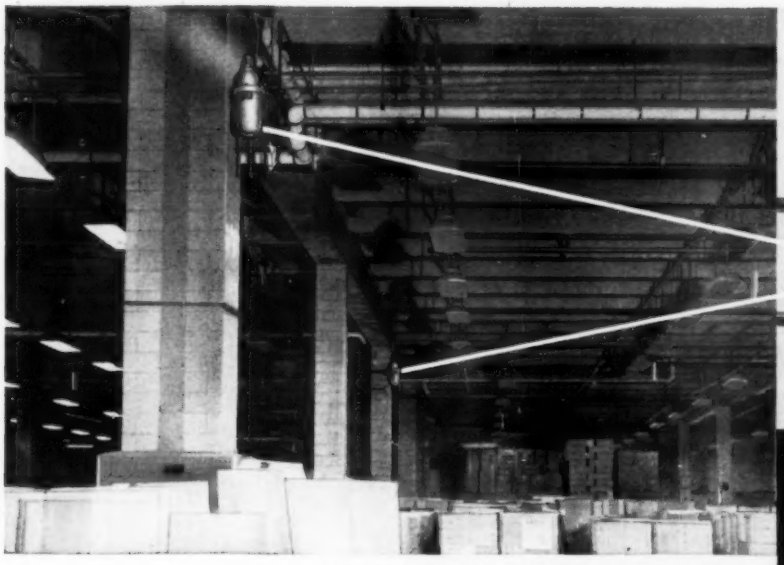

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—Alford Cartons Division, Continental Paper Company, Ridgefield Park, N. J.

FURNITURE MANUFACTURER

"By eliminating cracking and checking of wood due to dryness, Armstrong humidifiers save $5000 to $6000 annually."

—Vilas Furniture Co., Ltd., Cowansville, Quebec.

GENERAL OFFICE

"Static caused operating difficulties in business machines. Two Armstrong humidifiers overcame the problem."

—U. S. Rubber Co., Naugatuck, Conn.

LEATHER MANUFACTURER

"Armstrong humidifiers help keep leather soft, stop weight loss, help maintain quality."

—A. F. Gallun and Sons, Milwaukee, Wis.

PRINTING PLANT

"Armstrong humidifiers have eliminated production losses caused by static electricity on printing presses. Humidity was 20%, now 50%."

—Nazarene Publishing Co., Kansas City, Mo.

ENGINEERING OFFICE

"Colds and absenteeism have been reduced since installing Armstrong humidifiers. Before, humidity was 10%, and temperature had to be kept over 75° F. Now, at 40% humidity, comfort is maintained at 70° F."

—Burns & McDonald Engineering Co., Kansas City, Mo.

RUBBER COMPANY

"Because of an explosion hazard, machinery is set to stop when humidity drops below 40%. It has never shut down since Armstrong humidifiers have been on the job."

—U. S. Rubber Co., Indianapolis, Ind.

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Bulletin No. 500 answers these questions: How can dry air affect profits? Why must relative humidity be accurately controlled? Why is steam better for humidification? What do users of Armstrong Steam Humidifiers report? How are the units installed? What are the initial and operating costs? What are the sizes and capacities? . . . and many other questions you may have.

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DATA FILE

(Begins on page 218)

new ideas for protecting girders, tanks, boilers, roofs, other surfaces. Contains 100 color chips. Rust-Oleum Corp.

316 Painting with Aluminum — This helpful booklet describes advantages of aluminum paints, describes three basic types for non-absorbent surfaces, for weather-exposed wood, and for heated surfaces and those not exposed to weather. Typical maintenance applications are covered in text and picture, and practical suggestions are given. Aluminum Company of America.

317 Better Floor Care — This illustrated folder describes products designed to aid efficient floor care. Lists combination Scrubber-Vac machines, conventional scrubbing-polishing machines, steel-wool pads, applicators, vacuum cleaners, mop trucks and other equipment. Finnell Systems, Inc.

318 Light Scaffolds — This series of illustrated bulletins describes company's line of aluminum alloy Up-Right scaffolds and accessories. Pictures one-piece sections and multi-section models with various ranges of adjustability. Points out such features as locking hooks which provide automatic security and locking casters for safety on stairways and inclines. Up-Right Scaffolds Div., Up-Right, Inc.

STORAGE EQUIPMENT

319 Storage Equipment — Catalog 100-F, 72 pp, illustrates and describes company's complete line of steel cabinets, folding chairs, work benches, tool stands, shelving, tool storage, lockers, coat racks, filing cabinets, revolving bins, others. Includes dimensions and specifications, installation photos. Lyon Metal Products, Inc.

320 Adjustable Shelving—How this shelving can save assembly time is explained in 28-pp Form 2111. Photos and drawings of various types of shelving units, including open and closed shelving, bin units, ledge shelving, counter shelving, cabinets with swinging and sliding doors, parts and accessories are included. Standard Pressed Steel Co.

321 Storage Shelving—Rapid erection, strength and other advantages of manufacturer's storage shelving are stressed in this illustrated bulletin. Shows component parts, open types, closed types and some of the many combinations of dividers, bins, doors available. Also presents tool inserts, others. DeLuxe Metal Furniture Co.

322 Storage Racks, Bins—Many innovations in the Sturdi-Bilt adjustable storage rack and steel bulk bin lines are described in two bulletins offered by the company. Bulletin BB-956 covers steel bulk bins, with easy-to-follow charts for planning storage needs, and diagrams demonstrating construction principle for instantaneous readjustments. Bulletin SR-956, 8 pp, covers adjustable storage racks, with specifications. Sturdi-Bilt Engineering Co.

MATERIAL HANDLING

323 For Overhead Handling—Booklet 2008-M, 12pp, is replete with illustrative material on principal components of overhead handling systems. Track design and advantages of supporting it flexibly are described, and formulas and figures for comparing various track sections are included. Among subjects covered are various carriers for hand, electric and automatic operation; tractors; track switches; standard cranes, and transfer cranes. Cleveland Tramrail Div., The Cleveland Crane & Engineering Co.

324 Steel Conveyor Belts—"A profitable approach to the selection of steel processing conveyor belts" is the subject of this 16-pp bulletin. Simplified selection, standard specifications, and installation information are included. Photos and diagrams illustrate the text. The Colorado Fuel and Iron Corp.

325 Conveyor Belt Chart — Engineering data for standard conveyor belt construction is given in this chart and accompanying sheets. Strength characteristics of eight popular ply and material combinations of conveyor belt constructions given. Quaker Rubber Corp., Div., H. K. Porter Co., Inc.

326 Automatic Bulk Handling—Bulletin 530, 32 pp, on Airstream conveyors, presents information showing how pneumatic conveying has solved many bulk handling problems. System diagrams of typical installations point out applications and flexibility of conveyors. Over 70 illustrations show how air transports granular or powdered bulk material. Dracco Corp.

327 For Bulk Materials—Latest information on equipment for storing and handling bulk materials is contained in 12-pp Bulletin 574. Descriptions, specifications and dimensions of vertical and horizontal tanks are included. Cost savings afforded by bulk storage and handling facilities noted. The Day Co.

328 Cost-Cutting Materials Handling —"The How Book of Cost-Cutting Materials Handling," is a 24-pp booklet covering various phases of the materials handling problem and their effect on industrial production. Text and pictures cover such subjects as fundamental handling motions, advantages of planned material handling practices, analysis of handling organization, collecting handling data, diagramming travel. The Yale & Towne Mfg. Co.

329 How to Choose a Crane—Designed to aid in the selection of overhead cranes, 8-pp Unit 79 shows how to analyze handling problems, decide on the type of crane desired and draw up specifications for crane proposals. Basic data is provided on classes of crane service, crane ratings and capacities and recommended speeds for bridge, trolley, hoist. Whiting Corp.

330 Electric Hoists—Twelve-pp Bulletin DH 133B describes Speedway electric hoists of 500- to 4000-lb capacities. Fully illustrates and explains design features and gives details on suspensions and conducting systems. Clearance data included. Wright Hoist Div., American Chain & Cable Co., Inc.

331 Rugged Little Hoist—Twelve-pp Bulletin 158-E describes the Lodestar, a light weight but heavy duty, small electric hoist with push button control. Discusses low maintenance, safety, other advantages offered, and covers design features. Specifications and dimensions are given for both single- and double-chain models and accessories are illustrated. Chisholm-Moore Hoist Div., Columbus McKinnon Chain Corp.

332 Oil-Hydraulic Lifts — Catalog RE-203, 20-pp, covers the field of heavy-duty oil-hydraulic lifting devices for industrial applications. Featured in catalog are company's standard Levelator lifts, a 6000 lb single-jack model and a 12,000 lb dual-jack lift. Also featured is an electric pump mounted on an oil tank. Rotary Lift Co.

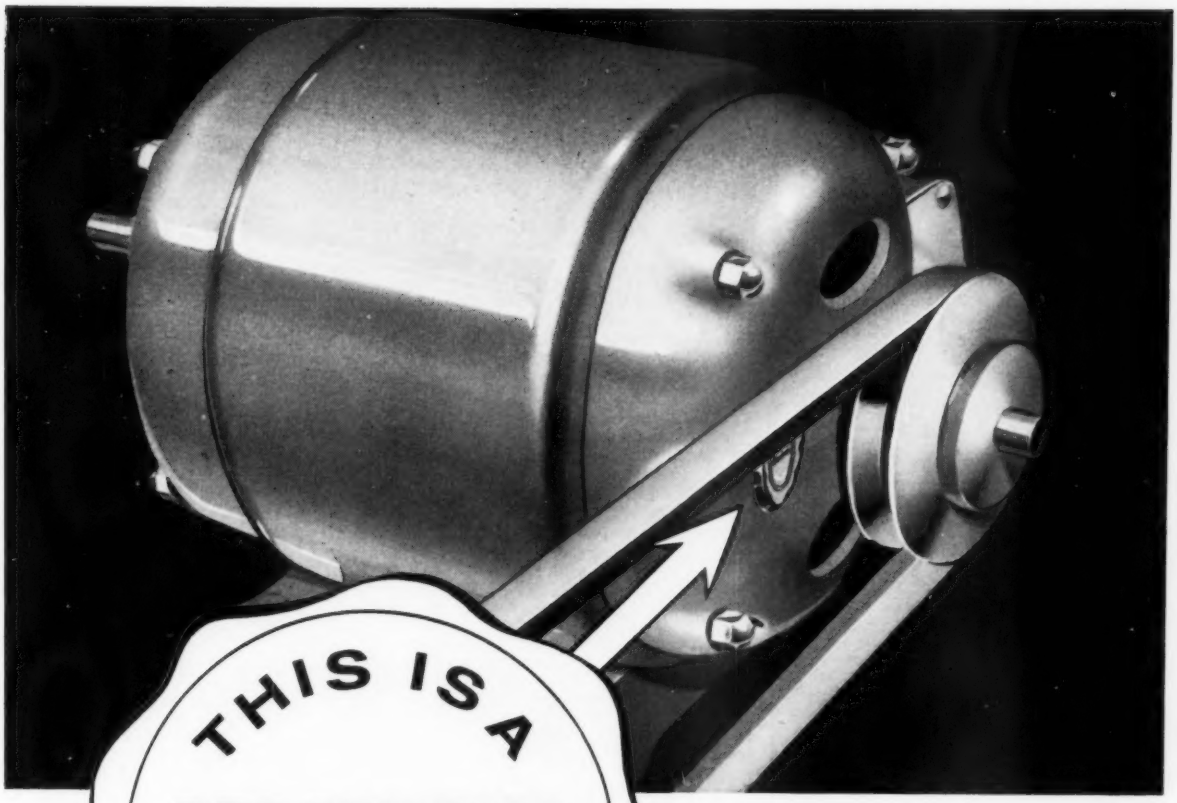
333 On Chain Block Safety—This wall chart illustrates safe handling of chain blocks. Sketches cover nine principles of handling, showing what should always be done and what should never be done. Reverse side of the chart gives data on company's line of chain blocks and trolleys. Shaw-Box Crane & Hoist Div., Manning, Maxwell & Moore, Inc.

334 Self-Dumping Hoppers—Bulletin 255 describes self-dumping hoppers reported to cut cost of hand unloading at least 50 per cent. Details rugged construction of the units, safety catch incorporated, other features. Standard models are pictured, as are some typical jobs handled. Roura Iron Works.

335 Casters and Wheels—This 192-pp manual, Number 60, contains detailed information on a line of casters and wheels designed for a variety of furniture and equipment applications. Dimensional data, specifications and price lists are provided for furniture and industrial casters and wheels, and photos, drawings and diagrams illustrating design and construction features are included. Darnell Corp., Ltd.

LUBRICATION

337 Lubricating Greases — Bulletin 49 features two grades of greases developed for maximum lubrication under special bearing conditions—heavy loads,



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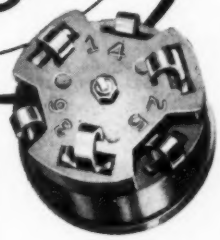

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DATA FILE

(Begins on page 218)

shock loads, and overloads. Uses, application methods, physical properties and benefits are detailed, and specifications are included. Sun Oil Co.

338 For Better Lubrication—Advantages of company's lubricants which are specially compounded for lubrication of reduction gear drives are outlined in pocket-sized folder. Features which assure smooth, trouble-free gear drive performance and lower maintenance costs are listed. Gulf Oil Corp.

339 Fundamentals of Wear—Vol. 42, No. 12 of this company's publication, "Lubrication," provides a 12-pp article on function of lubricants in reduction of wear and friction. Deals with phenomena associated with sliding, basic wear processes, interpretation of lubricant performance. The Texas Co.

VALVES, TRAPS, PIPING

340 High Pressure Valves—Bulletin B-451, 12 pp, contains complete engineering data on company's valves for high pressure and high temperatures. Typical installations are pictured, dimensions and weights are tabulated, and temperature-pressure ratings are shown. Yarnall-Waring Co.

341 PVC Valves, Fittings—This 16-pp bulletin describes polyvinyl chloride valves and fittings offering resistance to most salts, alkalis and acids. Bulletin provides application tables on performance of normal impact PVC valves and fittings for handling 315 fluids. Cutaway drawing and text detail design features. Walworth Co.

342 Valve Performance Facts—Included in this 36-pp booklet are 32 case histories of cost-saving valve installations. Service applications covered include steam, oil, water, coating fluid, chlorine, phenol, pulp stock, vacuum, others. Industries include paper mills, refineries, central stations. Crane Co.

343 Valve Comparison Chart — Form 194R, 22 pp, is a valve comparison chart, listing valve figure numbers of 15 major manufacturers and the OIC equivalent valve figure numbers. Compares variety of valves in ferrous and nonferrous materials, describes valve liners. The Ohio Injector Co.

344 Unions, Check Valves — Illustrated Catalog 55, 24 pp, describes and provides ordering information on a line of forged steel unions and check valves. Socket-weld, high-speed, orifice, Q-ring and other unions are included. Catalog provides service recommendations, dimensions and list prices. Clayton Mark & Co.

345 Industrial Valves—Bulletin 507V illustrates and describes company's line of industrial valves for control of air, gas, liquids and solids. Features photos and descriptive detail on a variety of valves, including butterfly valves, wafer butterfly valves, slide valves, check valves. W. S. Rockwell Co.

346 Hydraulic Control Valves—Catalog 200-7, 16 pp, describes construction features and advantages of company's line of hydraulic control valves. Photos, dimensional diagrams, circuit wiring diagrams, and complete engineering data are included. Logansport Machine Co., Inc.

347 Valve Lubrication—This 19-by-24 in. chart contains maintenance and lubrication information for company's lubricated plug valves. Of heavy paper with metal edges, the chart features detailed exploded views of four types of valves and includes a table of recommended lubricants for oil, water, gas and chemical service. Meter and Valve Div., Rockwell Mfg. Co.

348 Steam, Air and Gasoline Traps—Catalog 751, 32 pp, is a trap ordering book with capacity tables, installation diagrams, and containing charts and formulas for determining proper size trap for specific applications. Covers thermostatic steam traps, expansion steam traps, weight-operating traps. W. H. Nicholson & Co.

349 Pipe for Modern Buildings — This 16-pp booklet discusses wrought iron pipe for modern buildings. Identifies wrought iron pipe and describes composition and advantages. Included are sections on wrought iron's resistance to corrosion and fatigue stresses, weldability, forming and threading, as well as the application of protective coatings. A. M. Byers Co.

350 Bellows Design Guide—Twenty-pp Catalog 155 contains helpful information on applications, design considerations, and standards for metallic bellows. Details on using bellows manufactured from various metals are included. Flexonics Corp.

351 Swivel Joints—Catalog G-4, 32 pp, covers this manufacturer's line of ball-bearing swivel joints as well as other products, including loading racks, manifolding lines, all-metal hose. In addition to providing dimensional and operating data on products, booklet is well illustrated. Chiksan Co.

FILTERING

353 Filters, Strainers—Industrial Catalog 1054, 48 pp, provides application and engineering information on company's line of micro-filters and precision strainers. Fuel filters, full flow and by-pass lube filters, air separators, and metal edge strainers for fuel lube and industrial use are also presented. Purolator Products, Inc.

354 Data on Filters—Provided in this general catalog are product bulletins covering company's Staynew line of filters. These include intake filters, pipe line filters, liquid filters, hydraulic filters, automatic filters, dry panel filters, viscous panel filters, others. Catalog is available to qualified plant engineers. Dollinger Corp.

355 Air Filters—Eight-pp Bulletin 117 describes advantages of company's Poro-Stone air filters for compressed air lines. Typical applications are illustrated and described, and operating

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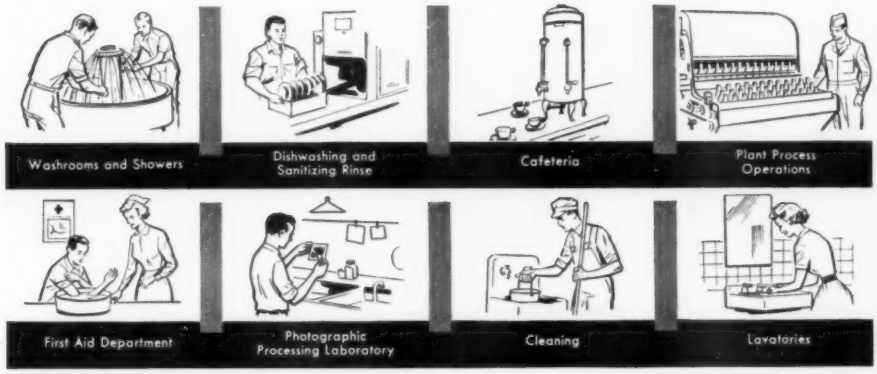

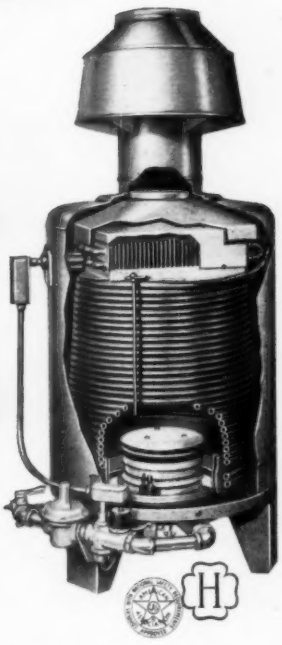

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DATA FILE

(Begins on page 218)

Aftercoolers and cyclone separators are also covered. R. P. Adams Co., Inc.

356 Filtration Equipment — Bulletin A-943 on industrial filtration equipment, covers company's Vacumatic filters, flotation equipment, Magnaflo separators for removal of ferrous solids, oil conditioner, cartridge filters, others. Includes application tips. U. S. Hoffman Machinery Corp.

MECHANICAL POWER TRANSMISSION

358 Fluid Drive—Eight-pp Bulletin 9819 describes and illustrates adjustable speed Gyrol fluid drives, 1- through 25-hp, giving advantages and applications. Components and operation are covered in detail and selection tables given. American Blower Corp.

359 Internally Geared Power—Featuring latest design improvements in gearmotors and embodying 60 multicolor illustrations, 16-pp Form F-1880 shows comparative advantages of gearmotors, lists ratings from ⅓ to 30 hp with gear ratios as high as 10:1. Cross-sectional details and enlargements of outstanding features are included. U. S. Electrical Motors Inc.

360 More Power per Pound—Book 2447, 28 pp, describes company's line of Gearmotors and Motogears, both designed in keeping with NEMA motor sizes which deliver more horsepower per pound. Provides complete selection data together with construction features, load classifications, dimension tables, overhung load ratings and mounting assemblies. Link-Belt Co.

361 Power Transmission Machinery—Bulletin A-646A, 8 pp, contains data on company's power transmission machinery, including sheaves, sprockets, bushings, conveyor pulleys, couplings, speed reducers, clutches, bearings, take-ups, V-belts, collars, and steel transmission pulleys. Also described is a dry fluid drive. Dodge Mfg. Corp.

362 Chains, Sprockets—Catalog 757, 68-pp, on company's stock roller chains and sprockets, stresses advantages gained through roller chain use, and pictures some typical roller chain drives. Tells how to select a stock roller chain drive. Provides specifications, ratings, prices and engineering data required for ordering. Book is generously illustrated with photos and drawings. Diamond Chain Co., Inc.

363 What's In a V-Belt?—Informative little 16-pp Booklet S-51105 describes raw materials used in producing V-belts. Natural and synthetic rubbers, cotton and synthetic cords, rubber chemicals and steel cables used in company's line are subjects for explanations of each material's role in the final product. Goodyear Tire & Rubber Co.

364 V-Belt Economy — Disadvantages of makeshift and other ill-advised means of coping with stretched or broken V-belts are discussed briefly in this folder. Answers questions on V-belt maintenance, inventory, wear. The Manheim Mfg. & Belting Co.

365 Flexible Couplings—Condensed Engineering Catalog 51-A contains excellent data on the choice and use of company's flexible metal couplings for power transmission. Tells advantages of these couplings and discusses design principles. Double-flexing and floating shaft types, light duty couplings and types for special applications are detailed. Thomas Flexible Coupling Co.

366 Coupling Data—Bulletin 240 describes a quick-connect, quick-disconnect H coupling, its uses and construction, with particular reference to U-packer which gives positive seal without compression set because of rubber distortion. A fully detailed cutaway of coupling is included and dimensions given. Snap-Tite, Inc.

367 Spacer Coupling—Of special interest to plant engineers concerned with operation of many pumps is Manual 4838 on this company's Type F Steelflex spacer coupling which has a quick-disconnect feature. Step-by-step illustrations show how to install, remove coupling and lubricate it during assembly. The Falk Corp.

VIBRATION CONTROL

368 Vinyl Machinery Mount—Advantages of company's vinyl machinery mount are outlined in this illustrated brochure. Installations are shown. Clark, Cutler and McDermott Co.

Postage-free Reader Service Cards make it easy to order catalogs. Cards are provided on pages 213 and 214.

369 Vibration Control Specifications—Bulletin F-2C shows how to write vibration control specifications for all types of air conditioning and related equipment regardless of the operating conditions. Contains a definitive treatment of factors involved in selection of various isolation media, with particular attention to the influence of existing job conditions. A selector chart included. The Korfund Co., Inc.

TOOLS, WELDING AND MACHINE SHOP EQUIPMENT

371 Portable Electric Tools — This standard catalog, Form 10, 24 pp, features portable electric tools, including electric drills, bench-drill stands, hole saws, buffing and polishing kits, sanders, polishers, grinders, hammers, saw blades, vacuum cleaners and others. The Black & Decker Mfg. Co.

372 Industrial Tools — Information on a complete line of industrial tools, including 500 new types and sizes never before offered, is presented in 120-pp Catalog 57. Included are complete lines of wrenches, socket wrenches, drop forged clamps, tool

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DATA FILE

(Begins on page 218)

holders, set up and hold down tools, cutting tools and pipe tools. Photos, drawings and numerous charts and tables are designed to aid in tool selection. Armstrong Bros. Tool Co.

373 Industrial Tools — Hand tools and shop tools for production lines, maintenance work and service departments are featured in 108-pp Industrial Catalog 54-1. Loaded with pictures and tool facts, the book describes in detail the complete line of over 4,000 tools — including chests and cabs, wrenches and sockets, screwdrivers, pliers, pulling equipment, tool assortments. Snap-On Tools Corp.

374 Pipe Tools — Ordering and application information on Ridgid pipe tools is provided in 16-pp illustrated Catalog 7596R-5. Wrenches, cutters, threaders, reamers, vises, and others are pictured and described, also power drives, pipe and bolt threading machines, oilers. Capacity, price data included. The Ridge Tool Co.

375 Data for the Shop—"Fluids and Facts for Metal Working" is a pocket-size booklet of about 44 pp. A section on metal working fluids covers their function and selection, preparation and use of soluble oils and paste compounds, and prevention of dermatitis. A section on metal working facts gives conversion tables, steel numbering systems, machinability ratings of metals. Standard Oil Co. (Ind.)

PUMPS, COMPRESSORS

376 Continuous Flow Pump—Bulletin 30-C, 8 pp, outlines advantages of company's Moyno pumps which handle a variety of materials—from free-flowing liquids to non-pourable pastes, abrasives, solids. Describes principle of operation, discusses performance, construction, capacities, and includes specifications. Robbins & Myers, Inc.

377 Pump Data — Application and capacity data on company's line of pumps, including centrifugal pumps, screw pumps, reciprocating pumps, and rotex pumps, are presented in this product bulletin. Photos of each of the models, along with descriptive detail, are included. Warren Pumps, Inc.

378 General Purpose Pumps—Section B, 36 pp, describes rotary pumps for general purpose use. Explains positive displacement principle incorporated, gives suggestions for selecting proper materials of construction. Application and ordering information is provided on mounted and unmounted small pumps, large mounted pumps, pumps for operations requiring greater sealing, and large, totally enclosed models. Viking Pump Co.

379 Vertical Non-Clog Pumps — Catalog F-100 describes advantages of company's vertical non-clog pumps, designed for sewage disposal, underpass service and drainage, and for many applications in reduction plants and paper mills. Three different dry pit installations are shown, and a cutaway illustrating mechanical features included. C. H. Wheeler Mfg. Co.

380 Condensed Pump Data—Form 4383-J covers more than 20 types of general service pumps, rotary pumps, sump and drainage pumps, condensate unit, self-priming units, stainless steel pumps and high-pressure pumps. In easy-to-find tabular form, each model is pictured along with its characteristics, features. Goulds Pumps, Inc.

381 Solids Handling—Bulletin 121-A, 8 pp, describes non-clog pumps for handling solids in suspension. Included are vertical, horizontal and close-coupled types used to handle liquid components of industrial processes, industrial waste, and for such pumping applications as water supply, drainage and sewage handling. Specifications are included. Aurora Pump Div., The New York Air Brake Co.

382 For On-the-Spot Air—Eight-pp Form 2302 features company's self-contained Spot-Air portable compressor. Deals with the many tools it will operate, with actual on-the-job illustrations pointing out added advantages of this light-weight compressor on jobs where bigger compressors are not needed. Ingersoll-Rand Co.

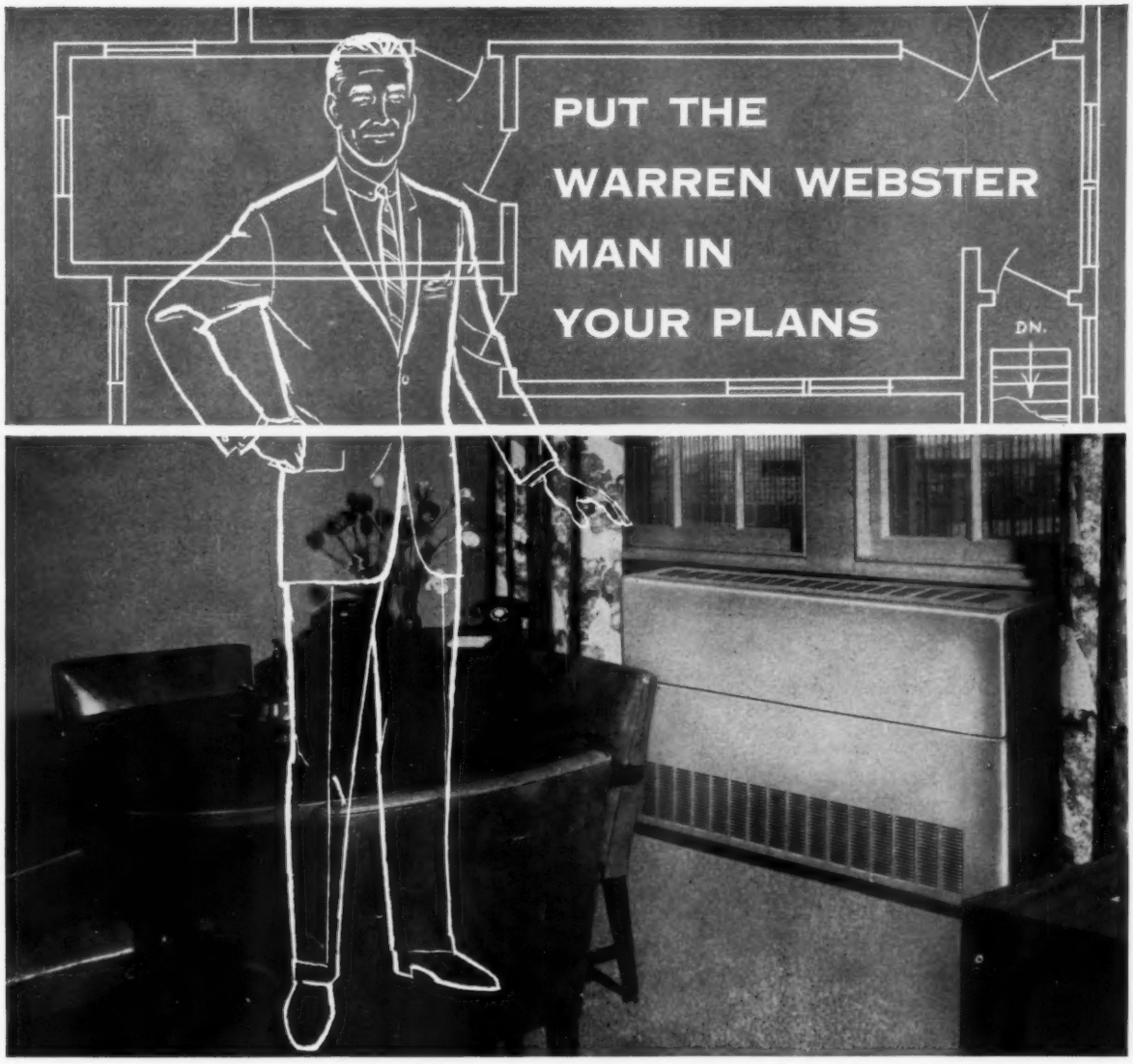
383 Industrial Air Compressors — Twelve-pp Bulletin A-43 describes company's vertical design industrial air compressors supplying moderate amounts of air on a continuous 24-hr heavy-duty basis. Design features are described and illustrated by means of a cutaway view, and specifications and dimensions are tabulated. Joy Mfg. Co.

384 Air Cooled Compressors—Bulletin AC-15, 16 pp, shows a complete line of small, air-cooled compressors for industrial, and other use. Both one- and two-stage compressors are covered, with working pressures ranging from 85 to 175 psi. Complete specifications for each model are provided. Gardner-Denver Co.

385 Industrial Compressors — Bulletin SSB-56 covers company's complete line of industrial air compressors from the ½ hp to 150 hp, including the accessories that go to make a complete installation. Photos of the various models are included, as well as specifications and dimensions. Schramm, Inc.

386 Turbo-Compressors — Bulletin 126-A, 12-pp, describes company's turbo-compressors which are designed to deliver constant pressure at all loads. Advantages are detailed, design and applications described, and pressure ratings of turbo-compressors shown. The Spencer Turbine Co.

387 Compressor Data—Feather valve compressors from 75 to 350 hp are described in 32-pp Bulletin L-676-B1A. Advantages on installation, operation and maintenance costs are outlined for types YC and DYC compressors. Information and illustrations are offered on component parts, including frame, running gear parts, intercooler, crosshead, motor and main bearings and various cut-away views are included. Worthington Corp.



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★ **Now, NEW (Patented) 'Sexauer' SELF-LOCK Monel screws, with an imbedded expanding NYLON PLUG, lock at the required depth AUTOMATICALLY, hold washers FIRMLY! Made of rustproof, non-corroding Monel, heads don't twist off, screw slots don't distort. They are easily removed when necessary, can be re-used repeatedly.**

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DATA FILE

(Begins on page 218)

PACKINGS, SEALS

389 Improved Packings — Advantages of company's Chevron packings for rams, plungers and reciprocating rods are illustrated and described in 8-pp Catalog AD-115. Tables show general recommendations for packings against various pressures, approximate depths. The Garlock Packing Co.

390 Sealing Compounds—Twelve-pp Bulletin 7009 describes Titeseal, a group of sealing compounds, each designed for a specific purpose. Tells where Titeseal is used, how it is used, and how it acts to stop leaks and waste and prevent seizure of parts by rust and corrosion. Describes basic Titeseal blends. Radiator Specialty Co.

391 Teflon Products—Three bulletins present this company's Teflon packings, gaskets, special parts and stock. Bulletin CP522 describes Chempro lines of Teflon ring packing, Teflon impregnated asbestos packing, V-type packing and Teflon seal cage—for use with acids and strong chemicals. Bulletin CP553 covers Teflon jacket gaskets, solid ring gaskets, expansion joints and special gaskets. Bulletin CP554 illustrates special parts. Chemical & Power Products, Inc.

ELECTRICAL

392 Totally-Enclosed Motors—Bulletin 500-A describes company's totally-enclosed, fan-cooled motors in ratings from ½ to 40 hp. Ratings and dimensions listed. Robbins & Myers, Inc.

393 Vertical Motors—Bulletin 2050 presents "climatized" vertical hollow shaft motors for shallow and deep-well turbine application. Advantages of the weather-protected enclosure are stressed and other construction features noted. Also explained are installation and maintenance time-reducing features. The Louis Allis Co.

394 Enclosed Switches—Catalog 83, 28 pp, and Catalog 101, 20 pp, describe enclosed switches for industrial uses. Included are general switches designed for use on either a-c or d-c applications, sealed switches, heavy-duty limit switches, hand operated switches, and maintained-contact switches, all of which are available in a variety of actuator designs, contact arrangements. Micro Switch Div., Minneapolis-Honeywell Regulator Co.

395 Switch Wiring Diagrams—Bulletin 709 is a 36-pp booklet of typical wiring diagrams for across-the-line starting switches. Indexed and arranged for easy use, this booklet serves as a guide to some of the many ways in which this company's manual and magnetic across-the-line starters can be applied. Some of the diagrams incorporate more than one useful feature. Allen-Bradley Co.

396 What You Should Know About Circuit Breakers—Sixteen-pp Manual 101 explains operating principles of basic circuit breaker designs and provides engineering data on factors of application. Includes simplified diagrams of three basic types. Illustrates with colored charts and diagrams, explains temperature factors, in-rush current effects. Heinemann Electric Co.

397 Secondary Unit Substations — Bulletin 9004-A, 20 pp, describes lower cost, complete flexibility and space saving of secondary unit substations. Photos and charts of construction are provided, also standard KVA ratings covering all types of indoor and outdoor substations. I-T-E Circuit Breaker Co.

398 Trolley Busway Systems—Three bulletins offer real help on electrical installations involving cranes and hoists, assembly and production lines, moving test lines and other moving electrical equipment. Bulletin 35 (28 pp) covers 225-500 amp systems; Bulletin 50 (44 pp) 100 amp systems; Bulletin 45 (40 pp) 60 amp systems. Each includes special sections on installation planning and procedure, methods of mounting. Feedrail Corp.

399 Electrical Equipment Digest — Electrical equipment illustrated and described in 138-pp Catalog Digest 139, includes load centers, circuit breakers, low voltage control, fusible service equipment, interchangeable hubs, meter equipment and accessories, meter sockets and troughs, safety switches, panelboards, duct and fittings, starters, magnetic breaks, relays, contractors other equipment. Square D Co.

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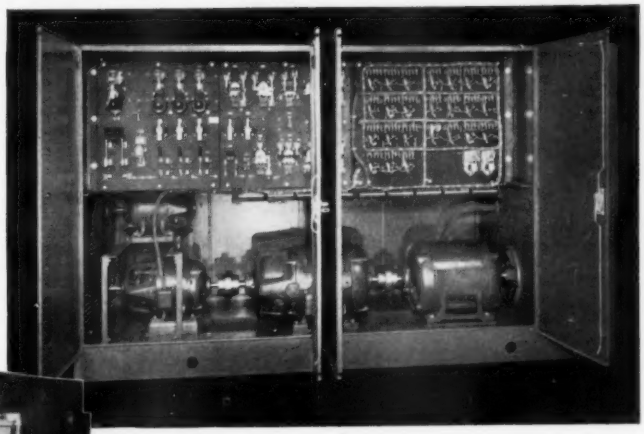

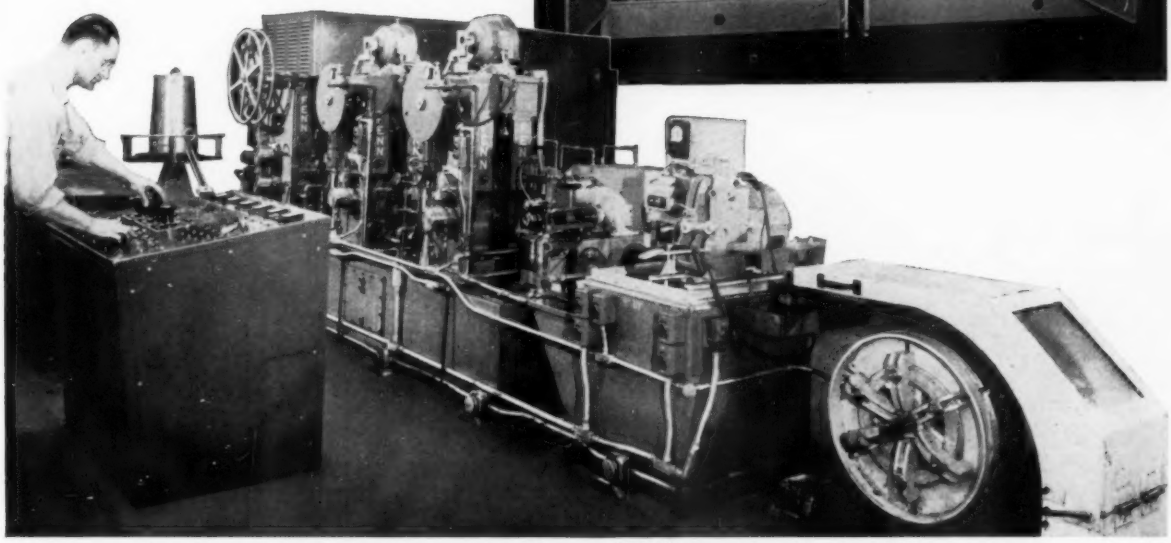

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Clark will either supply the drive motors, recommend proper motors, or design the "PSC" for motors owned or supplied by the customer.

"PSC" permits adjusting drive speed over a wide range by controlling motor armature voltage and/or field current. Modifications may be incorporated to adapt "PSC" to an almost limitless variety of applications where controlled-speed DC drives are advantageous.

Illustration shows a modern 3-stand tandem wire flattening mill with the individual stand drives synchronized electrically by Clark "PSC". Compared to similar machines in the same plant with mechanical synchronization, this mill is five times faster with more precise speed and tension control. Thus it holds closer tolerances and reduces breakage of light material.

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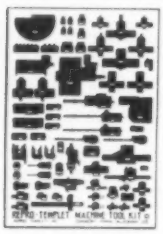

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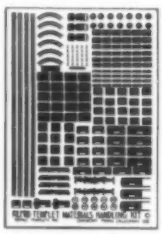

YOU GET: 207 Assorted Templets of different types and sizes of conveyors, workbenches, cabinets, bins, shop trucks, pallets.

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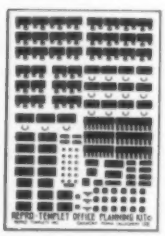


REPRO-TEMPLET OFFICE PLANNING KIT

YOU GET: 240 assorted Templets of various sizes and types of desks; file cabinets; chairs; supply cabinets; office machinery (IBM equipment).

PLUS: A 12" x 18" film grid sheet, marked in a ¼" graph . . . a roll of Repro-Templet Tape for marking off aisles, partitions, stock rooms, etc . . . . a complete instruction sheet, detailing clearly how Repro-Templets on adhesive-backed film should be used to prepare your office layout.

EACH KIT IS PRICED @ $10.00; OR THE 3 KITS FOR $25.00, FOB OAKMONT, PA.

While these trial kits, or collection of items, in no sense undertake to furnish each and every piece of equipment in a projected planning study, they will enable those concerned with the technical development of such layout or studies to decide on the values of the Repro-Templet methods.

A catalog of the available 10,000 Repro-Templets carried in stock will be furnished with each order.

REPRO-TEMPLETS, INC.
DEPT. PE
OAKMONT, PENNA. (ALLEGHENY CO.)

For more facts circle 635 on Reply Card

DATA FILE

(Begins on page 218)

400 Plug-In Duct—Advantages of company's plug-in bus duct are detailed in 23-pp Bulletin 300. In addition to descriptions and illustrations of various design and installation features, it includes specifications, curves plotting characteristics, and dimensional data and diagrams. Continental Electric Equipment Co.

401 Conductor Systems—This 36-pp catalog describes the Insul-8-Bar systems of mobile safety electrification for cranes, monorails and moving machinery. Includes photos and descriptions of typical installations, engineering data, installation procedure, a photo-text list of all catalog items that comprise these enclosed conductor systems. Catalog also explains how low cost safety is made possible by their simplicity. Insul-8-Corp.

402 Power Lighting Cable — Bulletin RR-10 describes company's Type RR-10 cable for power and lighting service. Technical characteristics of direct buried, aerial or conduit installations and sheaths are included, as well as tabular data giving physical dimensions. Triangle Conduit Co., Inc.

403 Wires and Cables—Interlocked armored cable, supports and fittings designed for low cost, heavy duty industrial, power or control wiring are described in this 24-pp bulletin. Photos and specific descriptions of various types of armored cables available for voltages through 15,000 v, single and multi-conductor are included. Arranged in table form are dimensional data. National Electric Products Corp.

404 Electrical Wires, Cable—Bulletin 1105, Section 1, 16 pp, features a cable selection chart and complete engineering information on company's line of electrical wire and cable. Advantages of the products are detailed, a table of insulations furnished, and design and construction features illustrated. The Okonite Co.

405 Cable Troughs—This 12-pp catalog offers a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings, horizontal elbows, inside and outside vertical elbows, ties, crosses, covers and many special fastening devices to save time and labor. Contains full instructions for installations, load charts. The Globe Co.

406 Protective Equipment Guide—Form SPD 56 is a 24-pp handbook on selection of protective devices for electric circuits, motors, appliances and apparatus, and is based on 1956 National Electrical Code. Besides providing suggestions on how to select right kind of protection, booklet provides wiring diagrams, motor tables, volt loss tables, others. Also shows switch size to use when fuse, Fusetron dual-element fuse or Fustat is installed. Bussman Mfg. Co.

407 Fuses for All Uses—This revised edition of manufacturer's com-

NEW DISCOVERY
SAVES PLUMBING BILLS

CLEANS INSTANTLY

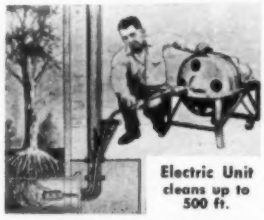
CHICAGO—January 1st—Factories, offices, machine shops, including homes are constantly having trouble with clogged-up pipes which proves expensive in Costly Plumbing Bills—

But now—using Water Impact and Air Pressure, here is a new unit called the **Plumber's Flushing Gun**, which cleans all lines up to 100 ft. It will open any number of bends in pipe. Yet anyone can operate this new gun, which triggers easily.

TOILETS, URINALS, SINKS, and FLOOR DRAINS clogged with paper, grease, rags, sand, and other debris can be cleared with one or more shots from the gun, **saving the owner, the Gun's price the first time it is used.** This new Flushing Gun may be used on any ½ to 6 inch waste pipe including Bathtubs, Floor Drains, Hot Water Pipes, House-to-Street Sewers, Septic Tanks, and Urinals. Obstructions melt away INSTANTLY when struck by the hammer like blow of this new unit.

This New Flushing Gun is offered on 30 Days Free Trial. BUT MOST IMPORTANT IS THIS — What is this Tool worth in **Costly Plumbing Bills** Saved in your Home or building. For your own good—Tear this Ad out now and write your name and address beside Ad for **Free Booklet.** No Agent will call—Obey that urge, mail now or write postcard. (Chicago Phone Kildare 5-1702) **MILLER SEWER TOOLS DEPT. PL-F 4638 N. CENTRAL AVE., CHICAGO 30, ILLINOIS.**

Free Catalog on Electric and Hand Sewer Equipment Write to Above Address



Electric Unit cleans up to 500 ft.

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Ray Moenich, our chief engineer, says:

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till we discovered

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We Build:
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- extruder controls
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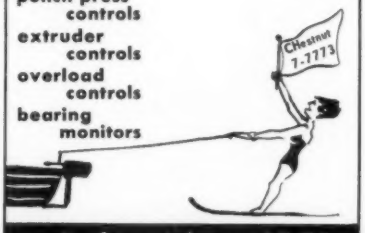

write for catalogue AC-3A
TIPPTRONIC, INC.
Chagrin Falls, Ohio

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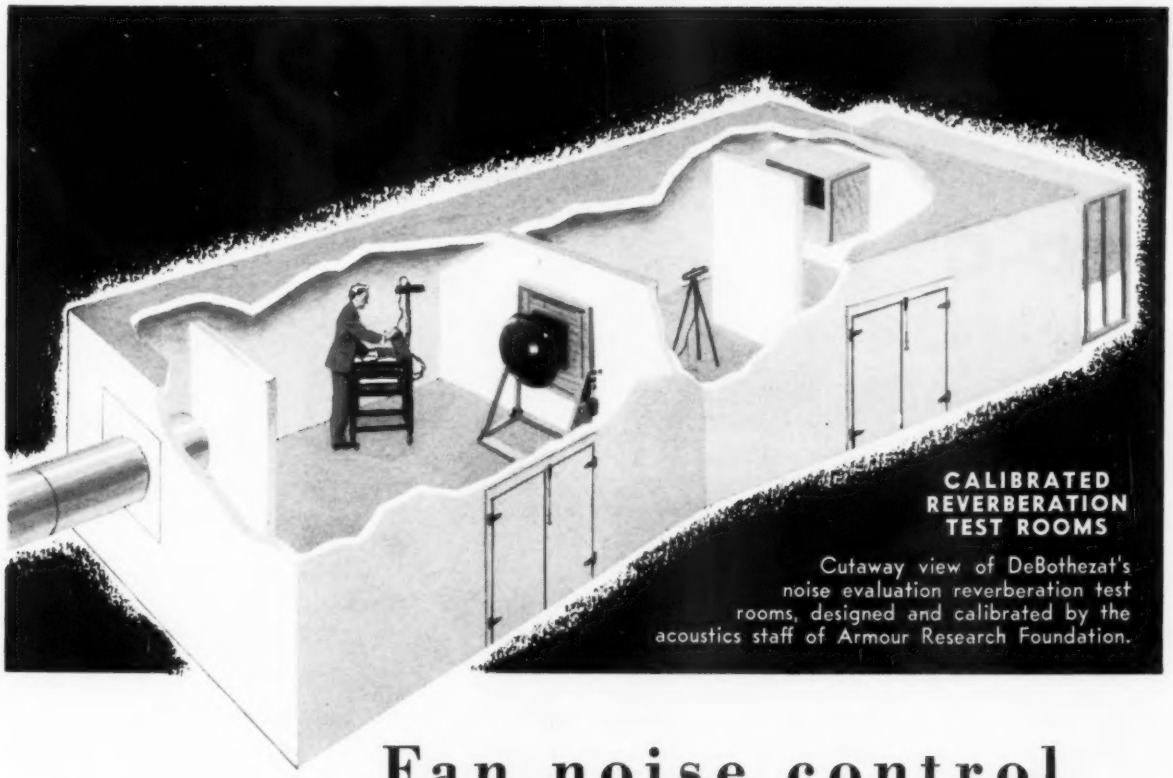


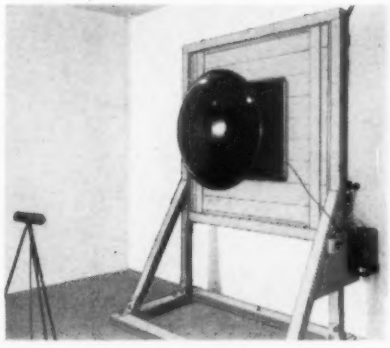
CALIBRATED REVERBERATION TEST ROOMS

Cutaway view of DeBothezat's noise evaluation reverberation test rooms, designed and calibrated by the acoustics staff of Armour Research Foundation.

Fan noise control begins Here

THESE REVERBERATION ROOMS are only a part of DeBothezat's continuing research program devoted to *predicting and reducing fan noise.* It's here that DeBothezat obtains the sound-output ratings (on both inlet and outlet sides) that are now available on all DeBothezat fan units, tested as a complete assembly.

Ratings are stated in both microwatts sound power and decibel sound pressure level in each of 8 octave bands of frequencies, measured separately. Next time you specify or install fans, ask your DeBothezat Sales Engineer for full information.

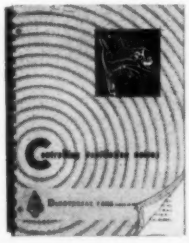


Interior view of the air outlet side of a DeBothezat noise evaluation reverberation test room, with a Power-Flow Roof Ventilator on test. Sound-level meter and microphone are in position — octave band analyzer not shown.

"Controlling Ventilation Noises"

$2 PREPAID

when requested on your business letterhead



De Bothezat FANS

A DIVISION OF

American Machine and Metals, Inc.

Dept. PE-158, EAST MOLINE, ILLINOIS

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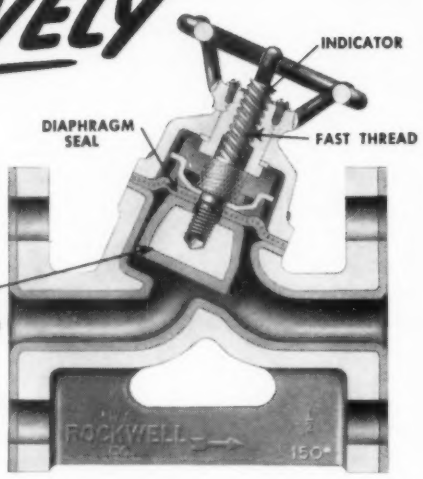
For more facts circle 638 on Reply Card

CLOSES and SEALS *POSITIVELY*

"D-D" Diaphragm Valve



Disc for Positive Closure
Diaphragm for Positive Sealing

- No packing gland to leak. Mechanism not exposed.
- Oversized ports; high capacity; low pressure drop. Largest capacity of any diaphragm type valve.
- Self-draining in horizontal position.
- Lower handwheel torque and fewer turns to close.
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- Body of any metal or with any lining. Sizes ½" to 6". Write for Bulletin 800

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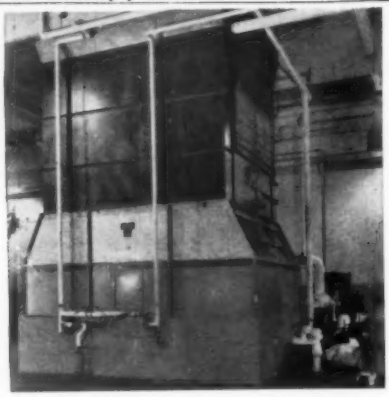

▶ Evaporating a very small amount of water in an air stream you can cool liquids, gases or vapors with atmospheric air, removing heat at the rate of input, controlling temperature precisely. Save 95% of the cost of cooling water; save piping, pumping and power. You quickly recover your equipment cost.

You can cool and hold accurately the temperature of all fluids, condense vapors, cool water, oils, solutions, intermediates, coolants for mechanical, electrical or thermal processes. You have a closed system free from dirt. You have solved all problems of water availability, quality or disposal, maintenance expense is low.

You may apply this to solvent recovery, vacuum systems controlling reactions, condensing distillates, cooling reflux products.

For more information, write for Bulletins 120, 124, 135. Address Dept.

NIAGARA BLOWER COMPANY
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Niagara District Engineers in Principal Cities of U. S. and Canada
For more facts circle 640 on Reply Card

DATA FILE

(Begins on page 218)

plete line, Folder 3 includes illustrations and descriptions of fuses for every purpose. Features dual-element cartridge fuses for time-lag in protection against overloads, and delay renewable fuses and renewal links. Economy Fuse & Mfg. Co.

408 Commutator Slip Ring Maintenance—This practical little 40-pp handbook gives procedures and methods for commutator and slip ring maintenance. Generously illustrated with photos and sketches, booklet contains sections devoted to common troubles and their corrections; brushes; general maintenance. Ideal Industries, Inc.

409 Asbestos Insulation — "Specifications for Asbestos Varnished Cambric N.E.C. Type AVA Lighting Wire and Power Cables." 8 pp, establishes performance tests for asbestos insulation applied as a felted wall in combination with varnished cambric tapes for wires and cables with 600 and 1000 v ratings. Rockbestos Products Corp.

LIGHTING, COMMUNICATION

410 Industrial Fluorescent Lighting —Design and construction features of industrial fluorescent lighting equipment are illustrated and described in 36-pp Bulletin b. Advantages of the equipment are detailed and complete specifications included, along with data on methods of suspension, power consumption table, dimensions, accessories and tables of coefficients of utilization. Benjamin Electric Mfg. Co.

411 Architectural Floodlighting — Eight-pp Bulletin GEA-6437 illustrates various methods of floodlighting industrial plants, public and commercial buildings and others. Provides information on general purpose heavy-duty floodlights. Also contains tips on floodlighting of vertical surfaces. General Electric Co.

412 Outdoor Mercury Lighting — "How Mercury Vapor Outdoor Lighting Brings More Night Action." 8 pp, stresses low cost and versatility of mercury vapor lamps. Shows their uses in industrial areas, parking lots. Sylvania Electric Products, Inc.

413 Illumination Design Data—Basic reference data on interior lighting installations is contained in 48-pp Manual A-4854, which features a section describing footcandle levels required for each group of seeing tasks. These footcandle levels are then related to many kinds of rooms and areas. A chapter on interior lighting design describes ways of calculating quantity of light. Westinghouse Electric Corp.

414 Mercury Floodlighting—Bulletin 2696, 15 pp, describes color, floodlight beam, and operating characteristics of mercury vapor lamps and discusses installations for which this type of lighting is best suited. Specifications, dimensions, and photometric data are included, as well as photos of typical installations. Crouse-Hinds Co.

COBURN®

OVERHEAD CONVEYOR SYSTEM

turns ceiling into dryer

...for the Walter L. Johnson Company, Endicott, New York

This leather processor is utilizing seldom-used ceiling space as a drying room—thanks to three Coburn Continuous Conveyors. The system works like this:

A sprayed finish is applied to each leather sheet. It's then attached to a Coburn conveyor by the sprayer operator. The system quickly carries the wet sheets high above plant equipment. There, completely out of the way, the sheets move back and forth at ceiling height. By the time they have reached the end of the conveying cycle, each sheet is ready for further processing.

Leather processor or not, it'll pay you to discuss your materials conveying and processing problems with the Coburn engineers. They'll submit easy-to-follow plans which, coupled with Coburn's simplicity of parts and design, will enable *your own plant engineers to set up your overhead conveying system* quickly and economically. Write today for Catalog #220 to Coburn Sales and Engineering, 56 Sterling Street, Clinton, Mass.

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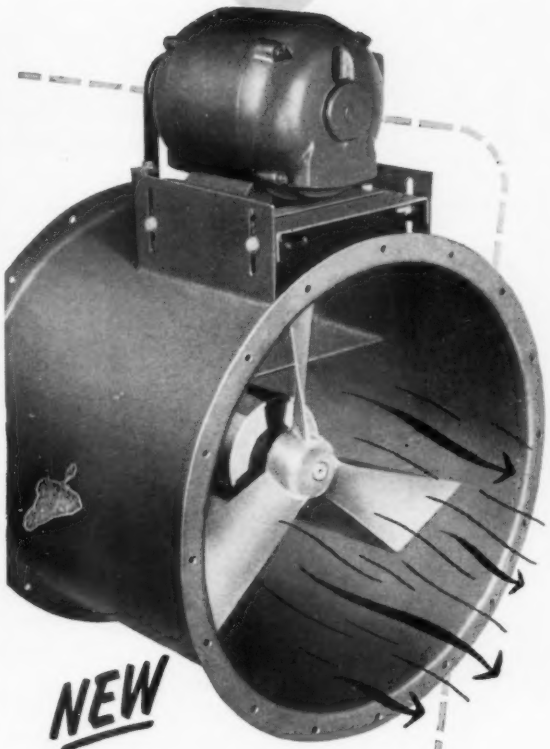
expel FUMES, HEAT AND DUST at LOW COST



NEW

PROPELLAIR®

belt driven Tubeaxial Fans

Type "BT" Propellair Fans can be purchased and operated at low cost to handle difficult atmospheres such as highly corrosive, explosive, inflammable, grease or dust-laden air. Straight-line design permits easy, inexpensive installation. Platforms and duct elbows are eliminated. The externally mounted Robbins & Myers motor, sealed cast iron housed bearing assembly, air-tight drum and belt-tube provide complete protection. Standard models can handle temperatures up to 450° F. Propellair "BT" tubeaxial fans are available in sizes 16" to 60" for from 2000 to 85000 CFM air delivery.

WRITE FOR BULLETIN NO. 620-PE

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MOVING AIR IS OUR BUSINESS

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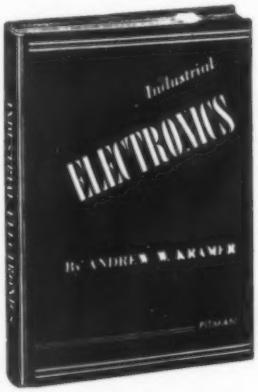

a practical book about Electron Tubes

what they are
how they work
how they can be used
what they can mean to you

INDUSTRIAL ELECTRONICS

by Andrew W. Kramer

This book explains in clear, simple, non-technical style the basic principles of electronics, and how these principles can be applied in industry. Electronics has been solving the unsolved problems. Whether it is navy beans, opening doors at a shadow, or measuring the thickness of red-hot steel plates, the electron is the newest and most efficient force captured by science. This book should be invaluable for the practical maintenance or operating executive or engineer. 311 pages, 229 illustrations, $7.00.

CHAPTER HEADINGS: Electron Behavior, Fundamental Principles of Electron Tube. The Simplest Thermionic Tube—the Diode. The Triode. Further Aspects of Triode Characteristics and Operation. Electronic Generation of Electric Oscillations. Multielement Tubes. Effect of Gas in a Tube. Types of Characteristics of Gas-filled Tubes. Mercury-pool Tubes. Photoelectric Tubes and Cells. Cold-cathode Tubes. Special-purpose Tubes. What Tubes Can Do. Electronic Control and Regulation. Application of Electron-tube Rectifiers. Electronics in Instrumentation and Measurement. Industrial Applications of Electronic Control. Application of Electronic Regulation. Electron Tubes in Light Production. Miscellaneous Electronic Applications.

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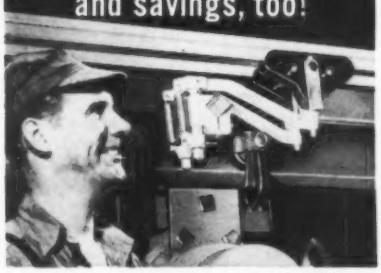

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Mobile Safety Electrification for Cranes, Monorails, All Moving Machinery.

These are the only enclosed conductor systems that meet *all* requirements of mobile safety electrification. Standard catalog parts eliminate the need for special engineering. Installation is fast, maintenance easy. Investigate today!

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Rush catalog re Insul-8-Bar mobile electrification.

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for **leakproof, pressure-tight connections**

use **TiteSeal®**

SEALING COMPOUNDS

Heat and vibration-proof, non-solvent, will not shrink, crack or crumble. Makes all assemblies leak-proof and pressure-tight. Prevents rust, corrosion, joint seizure.

7 BASIC BLENDS

LIQUID WRENCH®

The super-penetrating rust solvent

LOOSENS rusted bolts, nuts, screws, 'frozen' parts

Liquid Wrench works *fast*... yet is absolutely safe for all metals and alloys.

2171

At Industrial, Automotive, Hardware, Plumbing Jobbers

SOLDER SEAL

RADIATOR SPECIALTY CO.
Charlotte, North Carolina

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DATA FILE

(Begins on page 218)

415 Industrial Lighting — Designed to be inserted in company's lighting catalog, these two data sheets describe application, construction, installation and wiring details of two types of lighting units. Section 30, Sheet 20 features all-porcelain industrial units and Section 30 Sheet 18 covers vapor-tight units. Day-Brite Lighting, Inc.

416 New Light Source—Long life, brilliance, and other advantages of the Fluomeric Lamp which lights without a ballast are presented in illustrated Form 579. Cutaway diagram illustrates component parts and operation principle. Duro-Test Corp.

417 Television Equipment—Twenty basic applications for "TV Eye" low-cost closed circuit television equipment are described and pictured in Form 3R2335. Folder explains equipment's functions and operation, lists specifications. Radio Corp. of America.

418 Signal Equipment—Tips on how to select suitable signals for any specific operations are offered in one of a series of bulletins—Nos. 100-125—bound in this 40-pp catalog. Other bulletins describe horns, bells, warning lights, other signal equipment. Specifications, photos, wiring diagrams, dimensions, audibility rating charts, electrical characteristics and other data included. Federal Sign & Signal Corp.

INSULATION

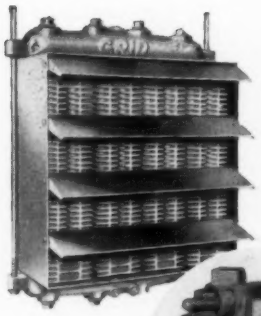
419 Insulation Specifications — This set of six specifications covers application of Foamglas insulation for industrial equipment and piping. Each booklet contains tables of suggested thicknesses of insulation to be applied, drawings of installation procedure, supports, and recommended finishes. Booklets are devoted to low-, medium-, high-, and dual-temperature equipment and piping, to underground piping, and spheres. Pittsburgh Corning Corp.

420 Piping Insulation — Seven-pp Bulletin SO 1054 features a snap-on, one-piece molded pipe insulation of fine glass fibers for hot or cold piping. Specifications are given for industrial, commercial, and institutional piping where maximum efficiency is of importance and for hot water and low pressure steam. Gustin-Bacon Mfg. Co.

INSTRUMENTS, CONTROLS

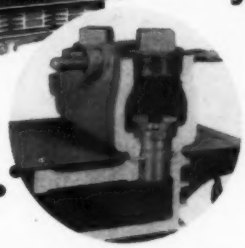
422 Automatic Controls — Automatic package controls, for virtually any industrial application where a chemical or mechanical function can be measured electrically, are described in 16-pp Catalog AC-2. These include control of temperature, torque, viscosity, current, voltage, timing of welding, conveyor overload, speed, plating, others. Tipptronic, Inc.

423 Versatile Electronics—How flexibility of electronic temperature controls makes them useful in a wide range

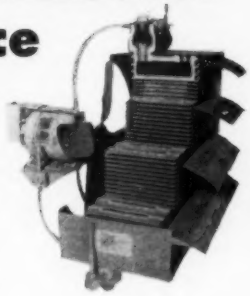


GRID

* Cast Iron - Steam Heat Transfer Surface



*ends Unit Heater Maintenance Problems!



Cut-away view of Model 2000 GRID Unit Heater . . . note double steam chambers in each fin section and wide fin spacing . . . fins are cast integral with steam chamber.

Your answer to unit heater problems, general industry has discovered through common failures of copper, aluminum, and steel tube heat transfer surface GRID condenser eliminates internal electrolytic corrosion—because all metals in contact with steam are similar. GRID also eliminates external corrosion—because the cast iron construction resists acid or other fumes in the air and eliminates the use of reducing valves where high steam pressure is used. GRID cast iron construction is tested to withstand steam pressures up to 250 P.S.I. . . . 450° temperature. GRID is built to last for years . . . uninterrupted service records of more than twenty years are common among GRID users in industry.

Send for the complete story on GRID Unit Heaters, GRID Blast Heaters, and GRID Radiation for industrial plant use . . . it is contained in GRID Products Catalog No. 956. Write today for your copy.

D. J. MURRAY MANUFACTURING CO.

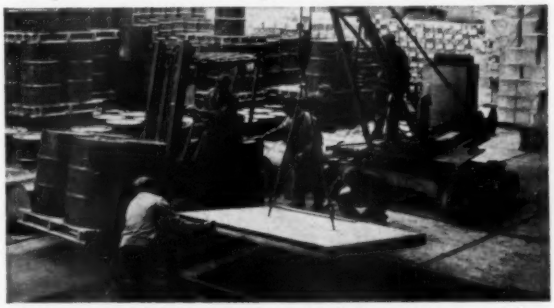
MANUFACTURERS SINCE 1883

WAUSAU, WISCONSIN

For more facts circle 646 on Reply Card

Prefabricated floor sections speed installation, cut maintenance on heavy-duty industrial floors

These floor sections ("Rafts") combine sub-floor and wearing surface; are quickly placed, immediately ready for traffic, readily lifted out and replaced.



Maintenance is reduced to replacement of individual 6' 8" square sections —a quick easy job while the work goes on.

Solves flooring problem in paper mill

Continental Paper Company, Ridgefield Park, New Jersey, operates 24 hours a day, shuts down only two weeks a year. The fork lift trucks they use weigh close to five tons loaded. Says Mr. George Cannie, Continental's maintenance supervisor: "Any kind of flooring we've tried before got chewed all to pieces in no time. It looks as if these Stelcon Rafts are going to last longer than any flooring we've ever had. And if we ever get a broken surface, all we'll do is lift the Raft and replace it with another. Practically no downtime."

Comparative tests show superior quality of Stelcon wearing surface and exceedingly high compressive strength

Special test equipment to simulate heavy duty traffic produced these results:

Material	Volume Loss after 480 rotations
Normal concrete	.915 cubic inch
Carborundum concrete	.915 cubic inch
Stelcon Rafts	.183 cubic inch

Comparative tests also show breaking of normal concrete at 3,000 psi, and Stelcon flooring surface at 12,000 psi.

This superior resistance to wear and high compressive strength is due to a revolutionary, double-reinforced construction. In each prefabricated unit is a sub-floor of special concrete reinforced with ⅛" and ⅜" mesh, topped by a ¾" wearing surface of straight Portland cement and steel chippings (no sand or other aggregate), all encased in an angle iron frame deeply anchored in the concrete.

FREE BULLETIN: Send for Bulletin No. 7 describing this practical solution to industrial flooring problems. Write to Bernard F. Preyer, Stelcon Industrial Floors, Inc., 165 Broadway, New York 6, N. Y.

Stelcon "Best where conditions are worst!"

For more facts circle 647 on Reply Card

DATA FILE

(Begins on page 218)

of heating and air conditioning installations is explained in this 16-pp booklet, Bulletin SA-2681. Purpose of publication is to fill the gap between the theory of electronic bridge circuits and specific control layouts and circuit diagrams. Four basic features that give flexibility are described. Minneapolis-Honeywell Regulator Co.

424 Temperature Controls — Eight-pp Catalog CC, on temperature controls and allied equipment for heating and refrigeration, provides information on recording, indicating non-indicating controls; thermometers; bulb installation accessories. The Partlow Corp.

425 Economy of Metering—Bulletin NI-57 contains 12 pp of cost-saving metering information, including a number of case histories. Also described are various meters and registers, maintenance rules, installation suggestions, and results of surveys in food and the chemical processing industries. Neptune Meter Co.

426 Overheat Protection — Bulletin MOPR-1, 8 pp, describes design and operation features of inherent overheat protectors—small devices built into electric motors to turn power off when windings get too hot. Includes photos and wiring diagrams illustrating operation. Metals & Controls Corp.

FANS, VENTILATING

427 Ventilation Units—Bulletin FM-315, 25 pp, describes basic construction of company's package propeller fans for commercial and industrial applications. Illustrated case histories of typical installations are included, as well as performance data rating tables, performance charts. Buffalo Forge Co.

428 Air Engineering Equipment — Bulletin 106 contains detailed information on company's line of air engineering equipment, including various types of air conditioners, fan heaters, spray coolers, concentrator, spray deck coolers, condenser, fan cooler, liquid cooler. Niagara Blower Co.

429 Air Engineering—Bulletin E-57 is a 24-pp air engineering data file covering engineering and test facilities for propeller fans, specifications, construction, maintenance, and installation. Tables for estimating air-handling requirements, entrance and elbow losses and duct sizes are provided. Also included are specifications for special-use equipment. Aerovent Fan Co., Inc.

430 Roof Ventilators — Sixteen-pp, Bulletin A-112, revised, covers manufacturer's line of reversible roof ventilators, also penthouse Vertijet, rotary and other models. Sizes, specifications, performance data are included. Hartzell Propeller Fan Co.

431 Industrial Fans — Propellair Bulletin 650, 12 pp contains dimensions, application, and performance data on Tubeaxial and Stackbooster fans. Gives information on cooling and drying problems, system and open surface tank ventilation. Robbins & Myers, Inc.

432 Induced Draft Fan Data—In addition to providing an illustrated discussion of design advantages of company's induced draft Bifucator, 20-pp Bulletin DB-44-56 is an excellent working tool on fan selection. Two methods are presented, along with detailed examples of each. Also included are boiler code ratings of various organizations expressed in Btu/hr, and charts on draft losses. DeBothezat Fans Div., American Machine and Metals, Inc.

SPACE, PROCESS HEATING

434 Plumbing, Heating Supplies — Edition H is the current edition of this company's 126-pp general catalog on plumbing and heating repair parts, tools and accessories. Indexed and illustrated; gives sizes, intended uses. J. A. Sexauer Mfg. Co., Inc.

435 On Unit Heaters—Latest improvements, specifications and performance data for Herman Nelson horizontal and vertical unit heaters are covered in 36-pp Bulletin 700A. Includes complete hot water and steam performance tables, dimensions, selections, applications, descriptions of cabinets, elements, motor mountings, fans and accessories. American Air Filter Co., Inc.

436 Unit Heaters—Catalog 157, 32 pp, contains performance and application data on company's line of unit

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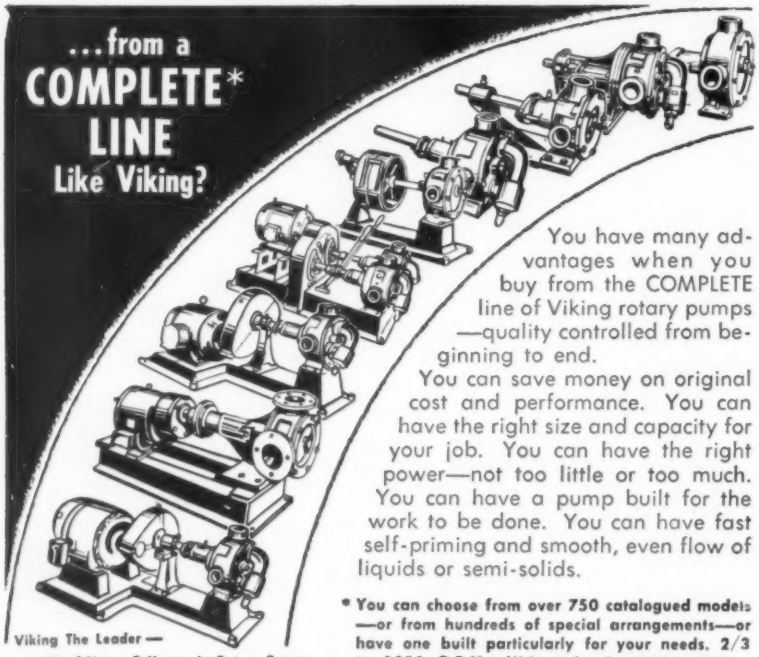

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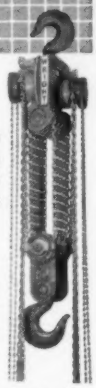

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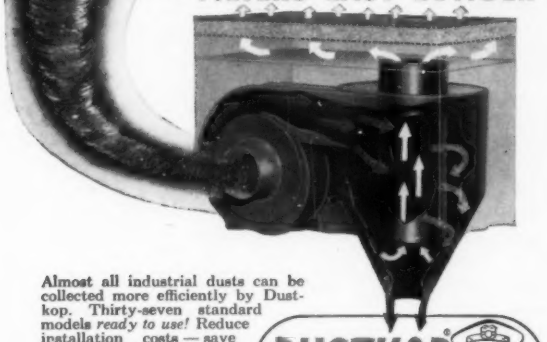

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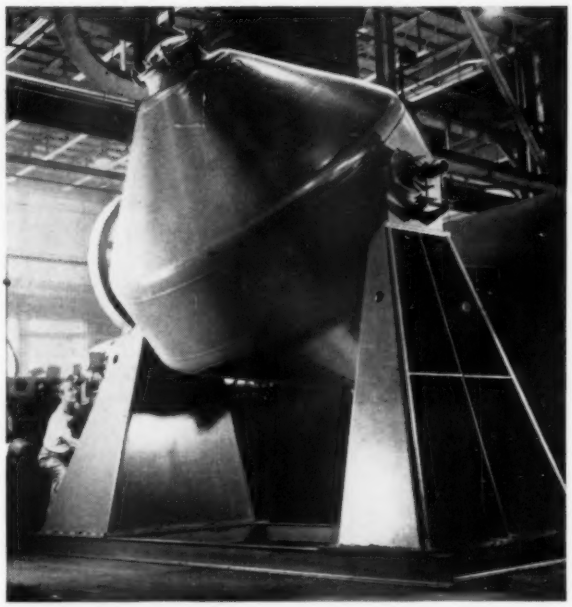

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DATA FILE

(Begins on page 218)

heaters, including design and construction details, dimension diagrams, and tabulated information on steam capacities, conversion factors, hot water capacities, performance factors, and heat transfer coefficients. Modine Mfg. Co.

437 Electric Unit Heaters—"Clean, Quick Heat at Your Fingertips," Bulletin 807, offers simple solutions to difficult heating problems. Gives sizes, capacities, dimensions and performance data on electric unit heaters in capacities from 180 to 1000 cfm, sizes from 1½ to 15 kw; 5118 to 51180 Btu per hour. Ilg Electric Ventilating Co.

438 Industrial Ovens—Thirteen types of company's Conventioneered ovens, which apply principles of forced convection heating to various industrial processes, are illustrated and described in 12-pp Bulletin 200. These ovens serve foundries, metal finishers. The W. W. Sly Mfg. Co.

439 Electric Heat, 101 Ways—Principal industrial heating applications and methods are described in "101 Ways to Apply Electric Heat," a 32-pp booklet. Illustrated case histories show how metal-sheathed electric heating units are being used. Physical aspects of installation are detailed along with a discussion of the problem, solution and advantages. Edwin L. Wiegand Co.

DUST CONTROL

440 Industrial Dust Control—A wide variety of collection methods for industrial dust control is described in 16-pp Bulletin 922. A typical case history is included, as well as photos, cutaway views, drawings and capacity data on the various units. Pangborn Corp.

441 Hydro-Filter—Bulletin 556 describes outstanding feature of company's hydro-filter for industrial dust collection. Cutaway view shows construction and design details, and diagrams showing dimensions and a table of capacities included. National Dust Collector Corp.

442 For Dust Collection—A collection of product sheets providing application suggestions and specifications on Dustkop equipment designed to solve a wide range of dust handling problems is provided in the Series 700 bulletins. Various models are described and typical installations illustrated. Also included is a section on accessories. Aget Mfg. Co.

443 Dust Collectors—Operation, construction, versatility and maintenance of company's unit dust collectors are explained in this bulletin. Includes sizes. The Kirk & Blum Mfg. Co.

BOILERS, GENERATORS

445 Hot Water Boilers—Catalog HCC-2, 20 pp, describes and illustrates design, construction, advantages and economics of company's controlled circulation hot water boiler for supplying high pressure, high temperature water for heating systems and process applications. Comparison of heat content—water vs steam—is included on table. Combustion Engineering, Inc.

446 Steam Generator Data—Bulletin C-731, 8 pp, contains detailed information on company's line of steam generators for all industries. Applications in both large and small plants are described, and performance and installation facts are furnished. The principle of controlled steam generation is explained. Clayton Mfg. Co.

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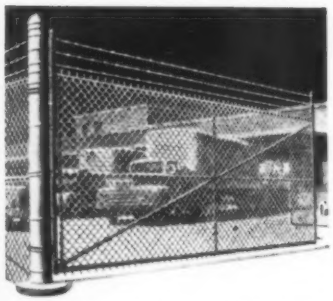

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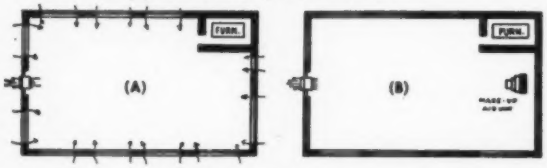

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DATA FILE

(Begins on page 218)

447 Packaged Generators—This 16-pp catalog describes a series of packaged steam generators in sizes from 10,000 to 46,000 lb of steam per hour. Gives capacities, dimensions, construction features. Instrumentation is discussed. Foster Wheeler Corp.

448 Automatic Boilers — Bulletin 1245, 24 pp, details advantages of company's packaged automatic boilers which provide low-cost steam for heating and processing. Illustrations of both oil and gas fired units are included. Orr & Sembower, Inc.

449 Inert Gas Generators—Bulletin IGG-155, 10 pp, describes inert gas generators for protection against fire and explosion. In addition to detailed drawings, photos, capacity and dimension tables, book contains a useful information sheet. Includes an analysis of the work to be done by generators, operating conditions, utilities needed. Roots-Connersville Blower Div., Dresser Industries, Inc.

SAFETY, SANITATION

450 Washroom Advisory Service—Form 1367, 34 pp, is an illustrated brochure describing company's washroom advisory service aimed to help in planning of well-designed, easily maintained and properly equipped personal service rooms. Describes basic washroom facilities, combination locker, shower and washrooms, and combination lounge, powder and washrooms. It also features washroom fixtures and towel and tissue supplies. Scott Paper Co.

On pages 213-214 are two postage-free Reader Service Cards provided for your convenience in ordering these catalogs. You may also use the cards to order any literature mentioned in ads.

451 Protective Clothing — Catalog 12000, 12 pp, describes and illustrates company's line of industrial clothing for protection against water, fire, acids and alkalis, slipping and scuffing. Various types of work gloves and suits and coats are featured, and protective advantages of this equipment are pointed out. The B. F. Goodrich Co.

452 Insect Control—Featuring manufacturer's insecticides and insect control equipment, this practical 36-pp booklet provides excellent tips on the control of industrial insects. More than 60 pests are pictured along with specific information on where they are found, identifying features, extent of damage, life stages and cycles, characteristics of existence, and recommended control measures. Ten insecticides detailed. West Disinfecting Co.

OTHER EQUIPMENT

453 Industrial Finishing Equipment—Catalog A-657, 12 pp, describes a complete modern finishing system for cleaning, rust proofing, drying, painting and finish baking operations. The R. C. Mahon Co.

454 Metal Cleaning, Finishing—Principles of metal cleaning are discussed in this 24-pp illustrated catalog. A variety of metal cleaning and finishing machinery is described, including conveyor type cleaning machines, monorail type cleaning machines, drum type machines. The Cincinnati Cleaning & Finishing Machinery Co.

455 Boiler Tube Expanders — Bulletin Y-46, 16 pp, describes three general types of boiler tube expanders and includes detailed specifications to assist in selection. Along with the specification tables, the bulletin includes photos, drawings and diagram illustrating typical uses. Lagonda Div., Elliott Co.

456 Preheating Combustion Air — This well-illustrated 36-pp booklet explains fuel savings and increased performance made possible by using waste heat in flue gases to preheat incoming combustion air. Also covers increased boiler output, ability to use lower grade fuels. Air Preheater Corp.

457 Mixed-Bed De-Ionization—Practical equipment for mixed-bed deionization at flow rates of 5 gal per hr to 5000 gpm is described in this 8-pp illustrated bulletin. Advantages of the

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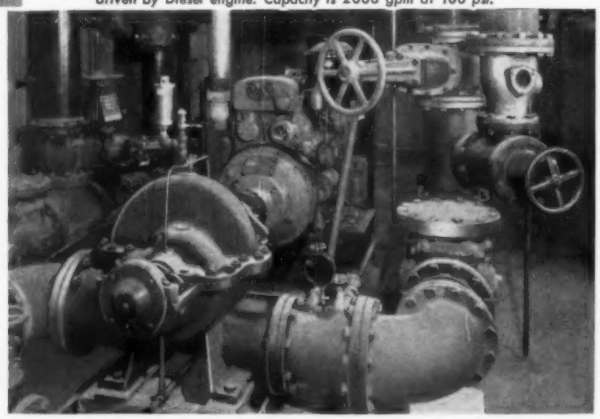

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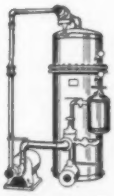

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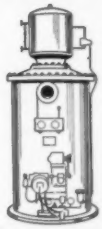

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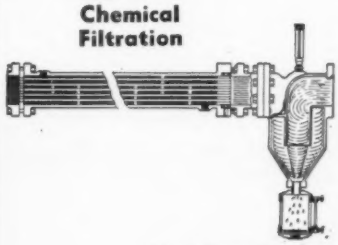

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DATA FILE

(Begins on page 218)

mixed-bed de-ionizer are detailed. Illinois Water Treatment Co.

458 Corrosion-Resistant Seals—Eight-pp Bulletin 938 describes corrosion-resistant seals and stuffing boxes for E, P, and R series vessels, stressing their interchangeability. Discusses five conditions to be considered in selecting best method for closing the opening between agitator and top of reactor. The Pfaudler Co.

459 Reproduction Materials — Provided in this 20-pp illustrated booklet on Kodagraph reproduction materials is a comprehensive materials selection chart designed to aid in finding material best suited to any reproduction job, from printed halftones, microfilm, and drawings with fine detail to soiled drawings and those in bad condition. Rest of booklet presents company's films, papers. Eastman Kodak Co.

460 Draft Starter—Capacity data for Quickdraft units are presented in 8-pp Form QF-SD. Seven capacity tables provide means for determining capacity of standard units when installed under hundreds of different conditions. An insert pictures and describes installations. Quickdraft Co.

461 Standard Storage Tanks—The broad scope of services to which company's standard storage tanks are put is covered in this 20-pp catalog. Such qualities as versatility and economy are stressed, and typical installations are pictured. Engineering standards given. Graver Tank & Mfg. Co., Inc.

462 Abrasion, Corrosion Protection —This 24-pp book illustrates how company's rubber faced steel plate reduces maintenance cost resulting from abrasion or corrosion. Shows case histories covering use in a wide variety of industries. The Gates Rubber Co.

463 Neoprene Design Book — This illustrated Bulletin discusses the properties of Neoprene, showing how they are utilized in products made from this chemical rubber. Covers its toughness, hardness range, air retention, performance under load, at extreme temperatures. Elastomers Div., E. I. du Pont de Nemours & Co.

464 Brinemaking Manual — Details on modern brine-making methods and equipment are presented in 12-pp Manual 135. Three types of brinemakers are described, as well as a wet salt storage system and cutaway views are included. Morton Salt Co.

465 Research Facilities—Twelve-pp Brochure 103-2M-956 describes research facilities available to industry on a contract basis. Services offered by this outside research staff in chemistry, chemical engineering, physics and mechanical engineering are explained, accompanied by case histories of recent research and development projects. Research Div., The Fluor Corp., Ltd.

466 Oilers and Safety Cans—Catalog 55-C covers company's complete line of oilers and oil and gasoline containers. Photos and drawings, as well as specification data and prices are included, and replacement parts are identified and pictured. An attached analysis sheet furnishes descriptive data. Eagle Mfg. Co.

467 Steel Reservoirs, Standpipes—This 24-pp booklet pictures installation of reservoirs of 50,000- to 10,000,000-gal capacity, having cone, umbrella or ellipsoidal roofs and ornamental structures with special architectural features. Chicago Bridge & Iron Co.

468 Venting Fundamentals—Tank vents, fittings, and accessories for fire prevention and vapor control are described in this 34-pp illustrated bulletin, covering venting principles, operating fundamentals, fire protection, maintenance, non-conservation venting, conservation venting, storage tank filling, storage tank rodding and sampling, fuel tank filling. The Protectoseal Co.

469 Humidification For Profit—Sixteen-pp Bulletin 500 presents data showing how relative humidity affects hygroscopic materials, health and comfort, and formation of static electricity. Schematic diagrams and sectional drawings demonstrate operation of electrically and air operated steam humidifiers. Armstrong Machine Works.

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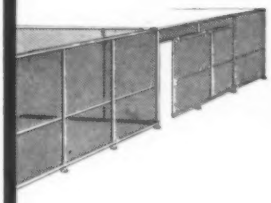

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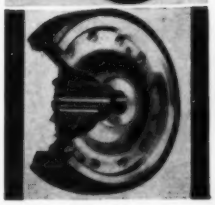

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Oil from heavy-duty compressors clogs ordinary ball-float traps—but not an Armstrong inverted bucket trap. The diagram at right shows how it handles even heavy oil.

(Warning—even an Armstrong will not handle oil-water emulsions described as "warm peanut butter".)

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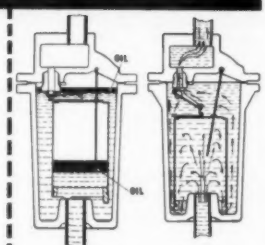

CLOSED OPEN

How It Works

CLOSED: Oil collects on top of water in trap. Air in trap floats bucket. Valve held closed by pressure.

OPEN: When water displaces air in bucket, bucket sinks, pulls on lever and opens valve. Oil floats out along with condensate.

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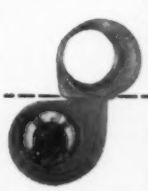

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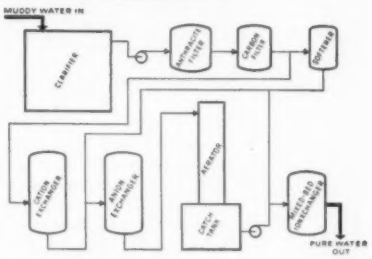

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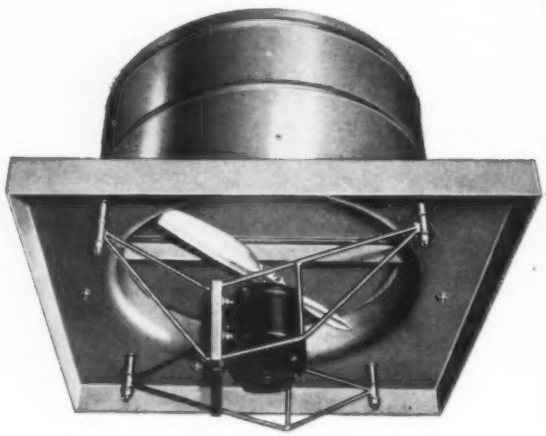
Design Simplicity OF HARTZELL *roof ventilators means...*



HARTZELL VERTIJET — Windband formed from 20 gauge galvanized steel, base from 14 gauge zinc-grip coated steel. Fan ring is integral part of base sheet. Two semicircular galvanized lids at base of windband open automatically when fan goes on, close weather-tight when it goes off. Throat sizes from 18" to 60"

HARTZELL REVERSIBLE ROOF VENTILATOR—One unit does the job of two conventional one-way ventilators. This unit moves air in either direction with equal efficiency; you convert from intake to exhaust at the flick of a switch. Throat sizes from 28" to 44".

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Hartzell fans and blowers are engineered and built for the exacting requirements of tough industrial service. There's no compromise with quality for the sake of shaving a few dollars on price. Hartzell fans are designed for the industrial buyer who is willing to pay for long life, dependable service and low maintenance.

HIGH EFFICIENCY...

These Hartzell roof ventilators expel large volumes of heat, smoke and fumes quickly and efficiently because simplified design reduces obstructions to air flow. There's no maze of interior braces and supports. And all Hartzell roof ventilators are tested for performance in accordance with Standard Test Codes of the American Society of Heating and Air Conditioning Engineers.

LOW INITIAL COST...

Elimination of complications of design and construction produce savings in production costs which are passed along to you. Hartzell design simplicity means that Hartzell roof ventilators can offer top quality construction for long life and dependable service at a price much lower than that of more complex designs.

MINIMUM MAINTENANCE...

By minimizing the number of moving parts Hartzell reduces the number of things that can go wrong. Lids on vertical discharge models are mounted on corrosion resistant brass rods which turn on heavy Micarta plastic bearings which require no lubrication... won't stick, won't rust. Fan motors are ball-bearing type, conservatively rated for continuous performance. Under normal operating conditions, the only maintenance required will be periodic motor lubrication.

Write today, or ask your nearby Hartzell field engineer for a copy of the free Bulletin A-112A. It contains all the specifications for the two roof ventilators pictured, as well as for Hartzell's Airjet, Rotary and Penthouse roof ventilators.

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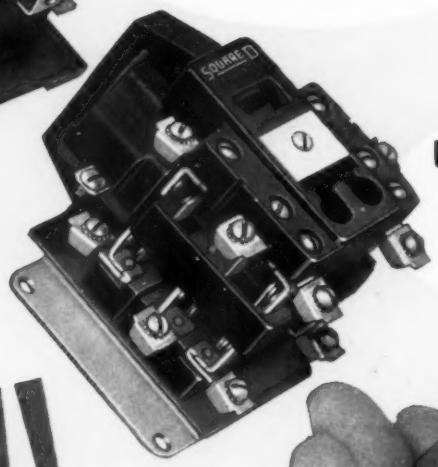

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- 600 VOLTS • 10 AMPERES • LONG LIFE
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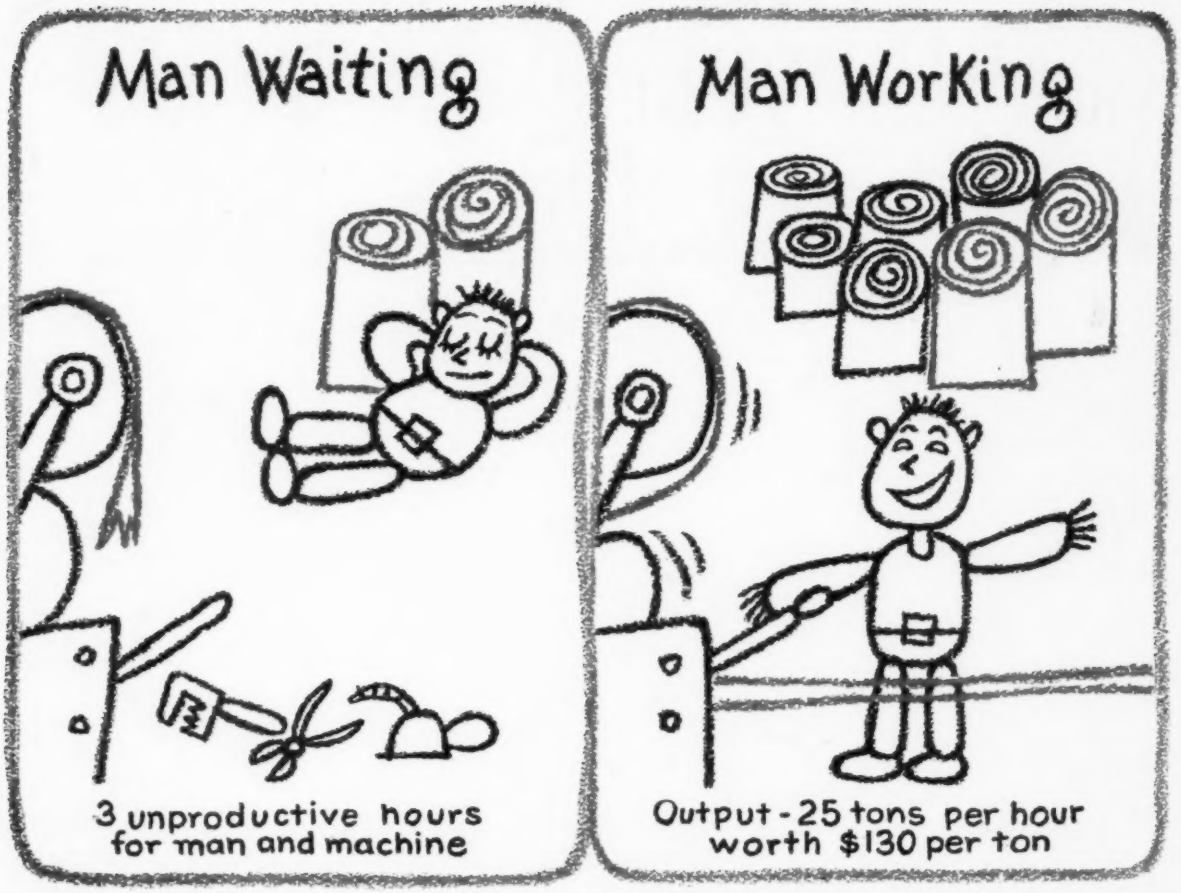

In the past, production losses due to breakdown of dryer roll bearings were so small they could be made up.

Today shut down of high-speed machines puts production behind by hundreds of tons per hour—quickly piles up losses.

Lubricating plan cuts downtime —can save $10,000 in 3 hours

Not so long ago, machines shut down by bearing failure could make up production losses. Today volume output and integrated production mean that production losses are losses in profit. These are the reasons behind management's growing concern with lubrication methods in their plants.

Take this example from the paper industry: they used to figure $500 for a bearing, $500 for labor (idle time and repair crew) and expected to make up losses on the two or three hours downtime. Today, high speed machines produce twenty-five tons of paper per hour worth $130 per ton. You can't ignore $3,000 an hour in production losses. In this case, the cost of the bearing replacement could run as high as $10,000.

Lubrication problems differ with specific industries, but the basic principles are the same. Many companies are finding that the services of a plant lubrication engineer pay off. His services can extend part life, eliminate production losses, reduce rejects, simplify lubricant inventories and otherwise add to income. Some companies delegate lubrication responsibility to engineers or plant personnel who also perform other duties.

In both cases, Texaco's organization of Lubrication Engineers is functioning in all 48 States, as consultants in outlining a practical approach to these problems. A more detailed discussion is available in an enlightening booklet: "Management Practices That Control Costs Via Organized Lubrication." Write The Texas Company, 135 E. 42nd St., New York 17, N. Y., Dept. E10.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

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FEBRUARY, 1958

Plant Engineering

IN THIS ISSUE

They Isolated Standard Equipment—
Reduced Installation Cost in Hazardous Area 84
Salesmanship: Plant Engineer's Most Important Skill 86
Plant-Built Crane for Low-Headroom Area 88
Pipe Chart for Water Friction 89
Water Is To Save—
Ideas That Conserve Dollars Too, at G E 90
4 Times as Much Light With No Re-Circuiting 94
Cash In on Test Stand Losses 97
Maintenance Has a Place in the Plans—
Central Shop Location Fits Proposed Expansion 98
Cooling Towers Rotting? 102
"Stop Accidents or Close the Plant" 103
Scrap Is a Program at Western Electric 106
Floor Stanchions Hold Conveyors, Here—
Office Building Converted for Plant Use 109
Water Tower Maintenance 112
"Most Automated" Coffee Plant 114
What About Oil Pour Point? 116
Drill Presses Adapted to Precision Work 118
How To Get What You Need in Pumps
III. Which Impeller Is Right for Your Job? 120
Air-Jet Wire Coiling 124
Stainless Sump Pumps Tackle Corrosive Liquids 126

REGULAR DEPARTMENTS

'Round About With the Editors 2
Bulletins and Catalogs 23
Backtalk and Forethoughts 28
Plant Engineers' Digest 38
Operation and Production 54
Construction Briefs 73
What's Just Ahead in This Issue? 83
News from the Plants 128
New Plant Construction 130
New Products and Processes 132
Industrial Films 188
Review of New Books 197
Data File of Commercial Literature 206
Advertisers' Index 232

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